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OF

OPERATIVE SURGERY;

WITH

An Atlas of nearly Three Hundred engravings,

REPRESENTING

THE PRINCIPAL OPERATIVE PROCESSES, AND A GREAT NUMBER OF SURGICAL INSTRUMENTS.

BY ALF. A. L. M. VELPEAU.

Surgeon to the Hospital of la Pitie; Fellow of the Faculty of Medicine of Paris; Surgeon to the Dispensaries of the Philanthropic Society; Professor of Midwifery, Anatomy, Pathological and Operative Surgery; Member of the Medical Society of Emulation of Paris; Corresponding Member of the Medical Societies of Tours, Louvian, &c. &c.

WITH AN APPENDIX OF NOTES,

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PREFACE.

In introducing a new treatise on operative surgery, my object is to meet a want long felt by those engaged in the practice of that branch of medical science. The work announced in 1813, by M. Roux, has not been completed. The additions of MM. Sanson and Begin, to the inimitable work of Sabatier, cannot, notwithstanding their importance, supply the place of a book of this character. The diagnostic and symptomatological details of almost every disease requiring surgical aid, in which the author has indulged, have enlarged his work, by encroaching on pathology to the injury of operative surgery. The only object of M. Richerand, in publishing his nosographie, was to present concise views of surgical science. M. Boyer, in confining his descriptions to his own views of practice, has omitted many methods which should be presented to the public. Besides, his work is not a special treatise on the subject, and the eleven volumes which compose it, do not afford the student a text book in the schools. A number of neglected operations, and others invented since the time of Sabatier, and already known to the learned world, have not yet found a place in our classic works. Rhinoplasm, chieloplasm, blapharoplasm, otoplasm, bronchoplasm, staphyloraphy, torsion, puncture of the arteries, lithotrity, cauterization of the urethra, amputation of the womb, extirpation of the ovaria and of the anus, are among these operations. Indeed, a review of the whole subject of operative surgery had become necessary from the progress it has made and the changes it has undergone during the last thirty years. My pursuits for the last ten years led me to the investigation of the subject, and convinced me of the deficiency alluded to; and I should have attempted to remove the evil sooner, but I feared the task was beyond my abilities. At first I conceived the idea of furnishing a simple manual; but I soon perceived that this course would increase the evil tendency of our young students, to content themselves with every possible abridgment. The researches which the undertaking required, have convinced me, under existing circumstances, that in order to be useful to the faculty and the world, a treatise must be full and complete, and not a mere manual.

Several volumes had been written when the journals announced the forthcoming work of M. Lisfranc. I then thought of arresting my labors; being pursuaded that from long experience in the dissecting room, and hospitals, this emi-

nent surgeon would accomplish all that was wanting. Five or six years have now passed away, and he has not fulfilled the expectations of an impatient public. Fearing that his numerous occupations would long deprive us of his able and interesting researches, I have determined to prosecute my original design. Another motive also induced me to postpone this work. Depending solely on the experience of the anatomical colleges, my opinions then could have been but of little value. Operations on the dead body could not be adopted, until they had passed the ordeal of the hospitals. My situation at that time, did not entitle me to the privilege of invoking my personal experience. But a practice of four years in the hospital of "perfectionnement," two years superintendence of the hospital of St. Anthony; and the direction of La Pitie since 1830, have enabled me to apply for the benefit of the living, the experience acquired from frequent operations on the dead. I hope I may be permitted to express an opinion on the propriety, either relative or absolute, of the different methods of operating, which ought to be examined in a work of this kind. Having witnessed the public practice of our great masters till within a few years, there are few operations which I have not seen performed. I have thus been enabled to compare the relative advantage of many of them, and to judge understandingly on the reasons which they advanced in support of the process they pursued, or against those measures which they condemned. Writing for the sole interest of truth and science, I have examined the labors of all without distinction of country, of school or of person; reserving the privilege of weighing their merits impartially, of drawing those deductions which naturally flowed from them, and in fine, of pointing out whatever seemed to me either useful or injurious. Under this point of view, the present epoch presents difficulties which can only be felt by those who wish to produce an impartial history. Cotemporaries are rarely just to each other. Animosity is too often transferred from the individual to the institution which he may direct. Instead of being published by their authors, the improvements and inventions, due for the most part to the great practitioners occupying the domain of science, are only known by tradition, or by the efforts of candidates impelled to defend the pretensions of their chief; it is indispensable in making a conscientious critique, to investigate carefully true sources of information. No work having yet been executed in this spirit—the surgical history of the nineteenth century being yet in embryo—I have found it necessary to consult a multitude of periodicals, private memoirs, and monographs of every description. A work of such great extent, in which all, should in some degree assume the character of mathematical demonstration—treating of dates, of inventions, of proceedings which gave origin to much discussion, of numerous controversies of which the end and object of all have been presented in so many different lights, interpreted in such a variety of versions, requires an attention, a care, a literary labor, and an extent of research of which it is difficult to form an idea without making the experiment. In executing this work, I have derived great assistance from the General Archives of Medicine, from the Universal Bulletin of Medical Sciences, and from the Medical Gazette of Paris, which laterally has permitted nothing of interest to escape the attention of its readers. The pages of the Lancet have sometimes afforded me supplies. I can say the same of the Review, of the Medical Transactions, of the Universal weekly Journal of Medicine, besides

every Journal, whether French or foreign, have been put in requisition. La Bibliotheque Chirurgicale of Languenbeck, the Journal of Græfe and Walthen, the Manual of M. Chelius, and the Treatise of Zang, have been very useful to me as regards the state of science in Germany; and for the same object, I have consulted the Medico-Chirurgical Review, the London Medical and Surgical Journal and the Lancet in England, where the classic works are generally so inferior. In Philadelphia, the North American Journal of Sciences, &c., the Quarterly Journal &c., Dorsey's Abridgment, Sterlings Appendix to my Treatise on Anatomy, are the sources I have had recourse to in the United States. From the Annales Universelles of Milan, by M. Omodei, and the Journal of M. Strambio, alone, I have been able to gather information in relation to the medical affairs of Italy. The collections of Thesis at Paris, Montpelier, and Strasburg, although too generally neglected, have afforded me much valuable information. They contain a crowd of suggestions, of propositions to which no attention was paid, of methods which have since been advanced by different authors, and appropriated as original, because the real author had retired and become forgotten in some distant province, where he had not the means of reclaiming the honor of his discovery. In fine, that nothing essential should be omitted, I have often addressed medical men themselves, particularly those whose researches had not been published, or those which had been written out by a third person. Thus, in order to be informed about certain operations of M. Dupuytren, I have inquired of M. Mark, his private student. By this means I learned that the discovery of the lachrymal duct originated in 1810, with the professor of the Hotel-Dieu, operating on an invalid who had been afflicted for many years; that he had removed the inferior maxillary bone twenty times, and that the superior maxillary had been removed by him in 1813; that his process for amputating at the shoulder joint dates in 1802; that he has tied the carotid four times successfully since 1814; that it was in 1805, and not in 1810, he applied a ligature to the femoral artery for a fracture of the leg; that his first operation for stone was (*hypogastrique*) at the Hotel-Dieu; and that he had attempted lithotrity eight times.

It is unnecessary to mention here the aid derived from MM. Roux, Richerand, J. Cloquet, &c. having recorded it in the body of the work. The same may be said of MM. Lauth of Strasburg, Ashmead of Philadelphia, Deleau, G. Pelletan, Berard, Blandin, Pravaz, Leroy, Maingault, and many provincial surgeons, to whom I am equally indebted. I learned also, from M. Mouline of Bordeaux, the success attributed to refrigeration in the treatment of aneurism; and nothing is more certain, than that all, or nearly all, the success was due to the concurrent means not mentioned in the report. I would have asked similar aid from M. Lisfranc, my colleague in the hospital La Pitie, but knowing it was his intention to publish his own course of operative surgery, I thought it would seem indiscreet, or that the request would be disagreeable to him. Though very desirous of profiting by his labors, I have concluded to derive my information from publications in the periodicals, either in his own name, or in that of his students; in the Thesis sustained for fifteen years by the faculty, and in the Manual of M. Coster. In order not to mutilate his ideas, I have used them with great reserve, hoping hereafter to be able to present them in his own language.

In relation to the doctrine which is foreign to modern practice, I have anxiously endeavored to trace it to its source; and this investigation has shown me how Sabatier himself and particularly Mr. Cooper have been so often led into error, in giving the ideas of those authors whom they had consulted. Where I could not attain my object from the scarcity of the works, or the foreign language in which they were printed, I had recourse to the authority of Spring'e confirmed by Le Clerc, Freind, Dajardin, or of Peyrilhe, and what is still more valuable, that of M. Deizeimeris, who, besides, on many occasions, procured me facilities and information which I could not obtain elsewhere, and among these I ought to mention the Historical Dictionary, with the praise, too, which a book concientiously written justly merits.

I have scarcely mentioned a fractional part of the titles of the books and entirely omitted the papers I have consulted. It seems to me that the opposite course, the advantages of which I would be the first to acknowledge, would have, in compiling a dogmatical treatise, a sufficient portion of inconveniences. In the first place it would cramp the style; 2, multiply its pages to an inordinate degree; 3, burden the memory; and 4, encourage that *imitative* learning, which is now unfortunately too extensive in the French schools. In abstaining from quoting the names of authors, I would have fallen into an unfortunate extreme, though most of our elementary books are composed in this way. It is true the author finds the advantage of permitting the unlearned to remain ignorant of the authorship of what he relates, and ignorance of historical research will prevent detection; but it seems to me nothing can be more injurious to the true interests of science. Students seeing no name in the text, attribute to the author in hand ideas that have been promulgated for ages, or recorded by twenty different writers; and thus become unjust without being aware of the fact. Hence that credulity so skillfully worked upon for years, and more so than ever, at present, by the inventors of new methods: hence that academic mystification and that mode of fabricating discoveries by numerous practitioners who are as liable to be mistaken as their pupils. In attaching to each subject I discuss the principal authority connected with it, I acquit myself of blame by rendering rigorous justice. I have thought that my opinion would thus acquire an irresistible influence, and ultimately that I should find my advantage in telling my readers in a single word, whether the inventions they were examining were of a recent date, or had been long known to others. To those who reproach me with leaving it impossible to verify my quotations with precision, I would say, that in recording the opinions of others, I have, in general, given them as I comprehended them, without rendering others accountable for my interpretration. Believing that I am addressing myself to students, I wish to let them understand that there is such a thing as history, and to impress upon them a taste for scientific literature.

The compilation of this work is another point which requires some explanations.

In performing surgical operations the importance of anatomical knowledge has never been questioned; nevertheless as it was impossible to embrace all collateral knowledge in a work on operative surgery, I have confined myself to that which is indispensable, and have chosen a form which seemed best adapted to an abridgment. Hence it is neither on the anatomy of the regions nor no surgical anatomy, so called, that I have written. I have simply re-

counted in each operation, the points which were absolutely necessary—those not essential I have passed unnoticed.

Sabatier, in other respects so perfect, who demonstrated science with such clearness and precision, was, nevertheless, defective from his poverty in descriptive details; and can neither satisfy those who confine their studies to the closet, nor those who practice in the anatomical schools. I have endeavored to avoid this evil without loosing sight of the opposite inconvenience; well aware how fatiguing from their dryness, and perplexing from their multiplicity, are these interminable details which we find in many of the recent publications. In fine, to satisfy all on this point, I have given to each case, as far as the limits of the work would permit, the particulars, both practical and mechanical, under the head of *manuel operation*, absolutely useful in performing an operation either on the living or the dead. The history, examination, discussion, appreciation of method, accidents, consequences and indications, forming the subjects of so many distinct heads, will be a great advantage to those who do not wish to read the whole article. I have used these divisions only in complicated operations; omitting them where the subject can be conveniently described in a few pages, unwilling either to treat solely of the *operative* process, or to write a book on surgical pathology; like Sabatier, I have confined myself to the discussion of the indications, omitting, without special necessity, whatever relates to the pathology, signs or general treatment of disease. The comparison of methods, and of the results which they have furnished, form another question hitherto too much neglected but of such unquestionable utility as to demand all possible attention.

If, in the course of my historical research, I have commented on operative processes long since forgotten or justly proscribed; if I have recorded a crowd of recent inventions of no intrinsic merit, and useless to the cause of science; it is because, on the one hand, there is no process so singular but it may again be revived by some new inventor, and, on the other, it is necessary to lay before the student not only what he should adopt, but also what he should reject in relation to the cotemporaneous history of data and opinions which he will daily hear unjustly praised or condemned. Though I have, in this double relation, endeavored to follow the course pursued by men of talents, and to present with precision and impartiality, the actual condition of science; though I have neglected nothing in order to procure the best information concerning modern improvements, still I fear that many useful points have been overlooked. Upon this subject, as well as upon all others, I will cheerfully bow to the criticism of the learned.

The engravings are not as numerous as the nature of the subject seems to render necessary; but the price of the work being already sufficiently high, I thought it ought not to be increased. All have been taken from nature with the greatest care, reduced in size, and marked with neatness and precision. I have chosen such views as will exhibit at a single glance, the whole operation. The object being to supersede long graphic details, I have paid less attention to richness and splendor than precision and clearness of design. The execution has been confined to one of our most distinguished artists, M. Chazal, well known for his talents in this line. The instruments which could not be found in the Hall of the Faculty, were procured for me by MM. Charriere and Sirhenry, two of the most eminent surgical instrument makers of

Paris. I cannot express too much gratitude for their kindness; and also for the politeness of the curators of the museum de L'Ecole, the MM. Thillaye. At one time I decided to collect the plates into an atlas, and to annex an explanatory text for the use of the amphitheatres; and I thought it also possible that I should make this subservient to another work on the same subject. The drawings of M. Maingault on amputations, of M. Syme on resection or operation at the joints, of MM. Froriep, Manec on ligature of the arteries, of M. Demours and M. Weller on the eye, of M. Bretoneau and M. Bulliard on tracheotomy, of Scarpa on hernia, of MM. Anderson, Houston, Segalas, &c., on the genito urinary organs, though more or less perfect in their kind, have been but of little use to me. Among others, those of M. Manec did not make their appearance till after the execution of my own, and besides being desirous of presenting the objects in a new light, it was absolutely necessary that I should have recourse to the dead subject. Lithotrity, staphyloraphy, &c., did not present the same difficulties. And I have so freely used the lithography of MM. Leroy, Civiale, Heurteloup, Tanchou, Tavernier, Roux and Schwerdt, that I have often copied them exactly.

INTRODUCTION.

Definition.—In medicine the term operation may be defined an action whose object is the amelioration of the organic condition of man. It is synonymous with surgery; but custom has given it a meaning, if not definite, at least much more limited. At present *surgery* is translated by surgical pathology, or rather pathological surgery, and embraces all diseases in the treatment of which topical applications form the principal remedies; while *operative surgery* is confined to the therapeutics, which require the hand either alone or armed with instruments. One is a true science scarcely different from medical pathology; the other leans more towards the arts. The first can only be advantageously pursued by those who are endowed with great aptitude for intellectual exertion; on the contrary, the hand is the indispensable and characteristic agent in the second. But it is impossible to draw an exact line of demarcation between them; as we see them constantly encroaching on each other in works purporting to be devoted to each.

If operative surgery is allowed to embrace rules for the application of cataplasms, plasters, ointments, leeches, cupping-glasses, blisters, moxas, acupuncturation, cauterization, seton, bleeding, &c. we cannot see why the reduction of fractures and luxations, the study of splints and bandages should be excluded. On the contrary case it is not less arbitrary in its point of separation. Catheterism in general, the extraction of a foreign body either from the ear or between the eyelids, the cutting of the frenum linguæ, require no more knowledge or address, than venesection or opening of an abscess. The manner of dividing this science is merely a matter of courtesy, which every man may construe according to his own views.

In omitting all that relates to dressings, treatment of wounds, &c. in order to speak of *operations*, I have had no other motive than the necessity of following a path already pointed out by custom. These branches of surgery having become the subject of special books which no student can dispense with, by reproducing them I would have labored unprofitably, as the details which my limits would have admitted could not supersede the special treatises of MM. Legouas, Bourgery, and Gerdy on petty surgery and bandages.

Classification.—The necessity of dividing operations into a certain number of classes has been felt at all times. The ancient classification laid down by

Celsus who referred all to *Diæresis*, *Synthesis*, *Exæresis*, or *Prothesis*, and which prevailed during so many ages in nearly all the schools of Europe, can no longer be maintained. In creating eight classes to supply their place Ferrein is still less successful. The reunion, the separation of tissues accidentally united, the dilatation and the re-establishment of natural canals, the closing or obliteration of useless channels, the extraction of certain liquids, amputations, extraction of foreign bodies, and reductions which he arranges in so many different heads, form a division in effect the least natural that could be imagined. *Diarthrosis*, to remove deformities was added to the four primitive orders since the time of Dionis. *Dilatation* and *compression* to which M. Roux allows a separate place, and *prothesis* rejected by Ferrein, appear unworthy and but imperfectly fill the outline. The exploration of the bladder, eustachian tube, and the lachrymal ducts, the injection of these different passages and simple torsion of the vessels for example, though important operations, would find no place under any of the above divisions.

The efforts of Lassus and M. Rossi, to obviate the effects alluded to, have been unsuccessful; and the plan adopted lastly by Sabatier is attended with so much trouble and inconvenience that no one will think of recurring to it. Indeed, of what incoherences are we not made sensible when we see in treating of the eye, for instance: *fistula of the cornea*, *hypopion*, hydropthalmia, *staphyloma*, *scirrhus*, *procidentia of the iris*, *foreign bodies*, *cataract*, and *artificial pupil*, &c, scattered here and there to the middle of three volumes and forming as many distinct divisions? By this arrangement it would be almost impossible to know where to find an article until we had previously waded through an interminable index. In order to ascertain how to open the anterior chamber of the eye, for instance, we would be compelled to consult by turns the second, third, or fourth volume, according as it treated on the extraction of pus, a foreign body, or the crystaline lens. In this point of view the essay of Delpech is still more defective. Indeed, the method developed by M. Richerand though one of the most advantageous for study, having genius equally for its foundation, is not entirely exempt from the defects so justly attributed to Sabatier. Hence it results that the topographical order recommended by J. Fabricius, and followed by M. Boyer, notwithstanding the repeated criticism, more or less just, to which it has been subjected, is still in operative surgery the best, and, perhaps, the only course that can at present be of any assistance to the reader. This is the only plan which conveys the same ideas to every one. By its aid all will know where to find *trepan*, *cataract*, empyema, lithotomy; whilst by following Sabatier or Delpech after first inquiring whether such operations belonged rather to *wounds and foreign bodies*, or to *fractures* and *styptics*, then to find in what order these different heads had been classed in relation to each other. The *pathology* and *cause* of disease, which render such divisions necessary, are too imperfectly known or too variable to serve as a permanent foundation for the classification of operations. In proceeding exclusively on the base of functional apparatus, or the organic system, we depart from fixed rules it is true, but then we are obliged to collocate the most incongruous subjects, (salivary fistula, abdominal hernia, polypus of the rectum, &c.) or to separate others, (foreign bodies in the trachea and œsophagus, tracheotomy, œsophagotomy, &c.) which have the greatest analogy.

We may present operations here under two general points of view: 1st, as independent and classed according to their analogy or difference; 2d, as therapeutic resources subject to the same divisions as the diseases which require them. In practice the first is applicable only to a few, such as trepanning, amputation, ligature of the artery and suture. Incisions, extractions, and special operations cannot properly be included. The second would be still more difficult to generalize; for if cataract, fistula lachrymalis, hare-lip, &c., may be taken as the heads of chapters in operative surgery, why not compound fractures, caries of the joints, gangrene, and gun-shot wounds, &c. Seeing, from the difficulties against which all authors have in vain contended, that it would be impossible to form a systematic classification, I have concluded to adopt the plan least embarrassing to the students, though perhaps least rational and less methodical. It is the only one, at least with some slight modifications, that can be followed in the anatomical schools. Hence I have undertaken to demonstrate, that the numerous operations of which the human body is susceptible, may be exhibited without exception, on one subject. The desire of attaining this object, induced me to introduce ligature of the arteries before amputations; and to describe them from the extremity to the trunk, without order or analogy. The operation of aneurism does not in effect interfere with the process necessary to exhibit amputation; while amputation would render it impossible to demonstrate the rules for the application of ligatures on the vessels. If, instead of passing in review, the amputation of the joints, the fingers, the hand, the wrist, the forearm, the elbow, the arm, and shoulder, I had treated first of *continuous* and then of *contiguous* amputations, one subject could not have afforded the means of exhibiting all. Besides, it seemed to me better to proceed with the trunk from the head to the pelvis; showing first the operation, then the diseases, then the organs or parts subject to them, as the guide and standard. The only object in adopting this method was to facilitate the study of the subject, and to aid as much as possible the memory of the reader; it is cheerfully submitted to the criticism of men of science.

Among operations all the data is given in advance, but no rules could meet the difficulties of some operations. The first, generally termed *regular operations*, are fortunately the most numerous and important. Under this class may be ranged amputations, operations for aneurism by the method of Anel, of harelip, of lithotomy, &c. The second comprehend tumors either cancerous or otherwise, which develope themselves on the scull, the face, the neck, the axilla, the abdomen, and which require extirpation. There exists a third class, which, in some degree, holds a middle rank; such as cancer of the breast, sarcocele, fistula in ano, hernia, re-sections* themselves, and the operation of aneurism by the ancient method. We know well the parts to be divided when operating for strangulated inguinal hernia; though we are often ignorant of the pathological condition of the parts reduced. Thus operations naturally divide themselves into three classes. In the *first*, the instrument acts on parts entirely healthy or little deranged by disease; in the *second*, it bears on points the anatomical relations of which have been changed, or for the removal of a tumor whose limits, if not naturally fixed, it is impossible at first to determine; and in the *third*, it is applied to affections the limits of which are easily esta-

* Re-section, indicates the cutting off the articular extremity of the long bones; or the ends of bones which do not unite after fracture. Tr.

blished—surrounded by points fixed and known; but the varieties of which are too numerous for established rules of operating in one, to apply exactly to others

Process on the dead Body.—The convenience of this division essentially practical, is thoroughly confirmed by experiments on the dead body. It is possible, indeed, to exhibit completely the removal of members, ligatures of the arteries, in a word, all operations that can be performed on the organs in their normal state; viz. on all of the *first* class, nothing of the kind, however, could take place in sarcoma of the face, maxillary sinus, amputation of the superior maxillary, of the parotid gland, of the thyroid gland, the cyst of the ovaria or the interior of the abdomen—in fine all of the *second* class. Every student knows also that the knowledge acquired in the amphitheatres* of ligature of the polypus, amputation of the neck of the uterus, operation for fistula in ano or perineo, and of hernia particularly, is very imperfect, and but feeble aid when called on to operate on the living patient. He would strangely deceive himself were he to believe himself perfectly master of all operations, merely from repeatedly witnessing the performance of them in the dissecting room. No one can be a skilful surgeon without having a long time practised these operations. They impart an aptitude, a steadiness, an address that the most precise anatomical knowledge can never supply. But this is not all even for operations of the *first* class. If the eye is more flabby, more loose, less transparent in the dead body, no idea of its mobility, of the tendency of the vitrous humor to escape, of the eyelids to contract and of the tears which constantly flow during life. When a limb is amputated, the tissues being more firm and tense are more easily cut before than after death; but in the latter case there is no retraction of the muscles, no blood to disturb or annoy, and no difficulty in ascertaining whether certain hemorrhage proceeds more from the veins than the arteries. Sometimes, when an artery is deeply seated, it cannot be discovered without dividing vascular ramifications, the blood from which so conceals the parts as to render the distinction more or less embarrassing; whilst on the dead body nothing analogous is to be met. The palpitation of the vessels, which at the first glance would seem to afford precise information, is so uncertain, so vague in regard to wounds, that very little advantage can be derived from that source. In *tracheotomy* and æsophagotomy, is it possible to simulate the least portion of the embarrassment which arises from the plexus of veins and the numerous arteries of the neck? In passing to the two other classes we must add their special, to these general difficulties. We never operate for fistula lachrymalis unless the angle of the eye is pasted up, ulcerated, or more or less altered. It is the same more frequently in the nasal fossa, when we are about to extract polypi. The motions of the throat, the desire to vomit, the mucous or blood, the lassitude into which the patient each moment falls, when we operate for hypertrophy of the amygdalæ, bifurcation of the veil of the palate, are never met with in operating on the dead body.

Caries and necrosis, which render excision of the joint absolutely necessary, always change essentially the surrounding soft parts. Whence it follows that there is no point of comparison between the process we are compelled to adopt on the living patient, and the freedom of our experiment on the dead subject. In each case, however, we know the number and situation of the tissues or organs to be divided—the part to be raised or separated; but suppose a morbid mass of considerable volume becomes developed in the perineum, what

* The Lecture Room.

assistance would the surgeon derive from the experiments of the dissecting room? What I have said in relation to the perineum applies to the groin, the axilla, the neck and every other part of the body. Without neglecting it, however, we ought to be careful and not attach too much importance to this species of experience. Experiments on living animals though infinitely more important under this point of view, do not possess every advantage. In the first place their formations being rarely alike, the results obtained by reasoning from the analogy are generally defective. Hence, in order to study an operation with the necessary care and judgment, it ought to be practised on the dead body, and also on the living animal; two sources of knowledge which mutually aid without being able to supersede each other.

Operative surgery is then definitely founded—*first*, on anatomy; *second*, on cadaverous experience; *third*, on vivisection; *fourth*, on pathological anatomy; and *fifth*, on the habit of operating on the living man.

Methods.—As there are few operations which cannot be performed in different ways, I have thought proper thus early to explain, by an appropriate word, the *ensemble* of which each method is composed. The terms, *method*, *process*, *mode*, have been indiscriminately used, and though nearly synonymous, these three words are used still in a variety of circumstances. It has been attempted, however, by M. Roux particularly to give each a distinct meaning. The expression *method*, for example, is taken in a much more extensive sense than the two others. Thus we say *method*, and not *process* or *mode*, in speaking of extracting or *couching* the cateract; while in performing lithotomy with the gorget, use the term *process* and not *method* as indicated by the modified operation adopted by M. Boyer. Ligature of the polypus is a *method*, but ligature of the polypus, according to the practice of such and such authors, is a *process*. In fine, we understand, generally, by the term *method*, some fundamental principle sufficiently extensive to be divided and variously modified; while the word *process* is more restrained, and is only used to designate the diminution of some peculiar method. Nothing could more clearly prove the propriety of these distinctions, than the operations for aneurism, for amputation, hydrocele, and lithotomy. To apply a ligature to the artery without touching the tumor is called a *method;* but place it higher or lower, and it is called a *process*. To open an abscess is denominated a *method;* the manner of opening it is a *process*. To resume—*method* embraces the entire subject; *process* relates to each of its modes of application. In common parlance, therefore, it is necessary to adhere to these purely arbitrary terms; and not to use, as is frequently done in works more carefully written, the words *process*, *mode* of operating in the place of *method*, and *vice versa*. Fistula lachrymalis, among others, proves it completely; the term *method* being applied indiscriminately to the *process* of Dupuytren, Desault, and Boyer. Hydrocele, hernia, and lithotomy are equally liable to the same remark. *Process*, the method of cauterization and of injection; *method*, the process of dilatation and solution; *process*, the method of Frere Come are daily used. This subject is one, however, of secondary importance; and in such a discussion every one may reject or adopt these conventional terms, without being held to account for it.

1st. *Before the Operation.*—The first object which demands the solicitude of the surgeon before performing an operation, is its indications. It is on

this point that the most extensive and most precise medical knowledge is indispensably necessary. After having satisfied himself that the cure can only be effected by an operation, he should still be convinced of its utility, and also that the patient incurred less danger in submitting to it, than in laboring under the disease. Hence, it is only by the aid of a diagnosis, enlightened by the clearest and most precise knowledge of pathological anatomy—of a prognosis drawn from what the soundest judgment may apprehend of the progress or of the probable issue of the organic derangements, and of an appreciation as exact as possible of the power and value of the ordinary therapeutic agents that the first problem can be solved. And, besides, none of its relations appears to me to be considered in a proper point of view. I wish to speak of the choice to be made between the operation and the other therapeutic agents which we may wish to substitute for it. Thus because the lachrymal tumor, has lately been considered not within the domain of operative surgery, having yielded sometimes to regimen and antiphlogistics—that certain tumors of the breast having been dissipated by compression, it would be, in my opinion, highly improper to conclude that all this treatment should precede in order to render recourse to the knife unnecessary. Indeed, it does not concern us to know if cancer, or any tumor whatever, can be removed by the action of such and such medicines or by the knife; but which, in the last resort, offers the greatest advantages. I grant that the frequent application of leeches, emollient cataplasms, abstinence, &c., cure a number of tumors and even fistula lachrymalis; but is it hence to be concluded that the treatment, whose success is not even uniform, and requires to be continued several months, ought to be substituted for a metallic tube in the nasal canal—a matter which is effected in a second, removing in two days a disease of ten years standing, and restoring the patient to health in a great majority of cases? That leeching and regimen may triumph over some masses apparently scirrhous or cancerous I will not deny; but if these tumors remain movable and are favorably situated who will assert that the bistoury will not remove them with much more certainty and rapidity? and by affecting less seriously the general physiological condition of the system, diminish the sum total of human suffering. What has been said in relation to cancer and fistula lachrymalis applies to a number of other diseases; forming the foundation of a remark that the surgeon ought never to lose sight of. If it is cruel to use the knife on those who might be cured in a more gentle manner, it would still be less conformable to the interests of humanity to compromise the future health of the patient under the vain pretext of averting a little present pain.

Nearly all the *preparations* to which patients were formerly subjected previous to operations have been abandoned by the moderns. Still there are some which should be observed when the disease will permit delay. The choice of season is not certainly a matter of indifference; *cæteris paribus*, spring and autumn ought to be preferred to winter and the heat of summer; not because the temperature is more mild, but because the system is then better able to resist general morbific variations. Thus it is rational and prudent to postpone operations for the stone, cataract, the removal of large tumors, and all operations which deeply affect the vital functions, till temperate seasons; unless from some peculiarity of the patient, we have reason to pursue another course. But too much importance is not to be attached to this pre-

caution; there is no time of itself capable of destroying the success of an operation; and the question of season is only an affair of *better* or *less favorable.* No doubt the appearance of an epidemic should be a powerful reason for temporizing; and that the morbific conditions of the moment should be regarded. In choosing the morning rather than the evening, the operator has the advantage of finding his patient less fatigued, and he is better able to watch his wants immediately after the operation; but, besides this, there is nothing that renders the morning indispensable, and the most plausible motive is that the forenoon is generally more convenient for all. As regards urgent operations, they must be performed when exigency requires, without reference to the seasons or hour; and hence, authors have been led to establish a time of *choice* and a time of *necessity.*

The moral precautions vary, and ought necessarily to vary, with the individuals. The first is, to inspire the patient with unlimited confidence in the surgeon, and all that confidence is acquired in a thousand different ways. The second is to convince the patient that the operation is the only means of arresting his sufferings, and to disabuse his mind if he exaggerates the danger. To resume it is necessary to do every thing, within the limits of truth, that may induce the patient to desire the operation, if not with pleasure, at least with resignation. There are two sorts of individuals to be encouraged on this point. One is of extreme timidity, frightened at the idea of the slightest stroke of the scalpel; whom it is necessary to deceive as to the severity and acuteness of the pain, and also to the dangers to which he is exposed. The others think that in public establishments the operation will be performed *nolens volens,* and therefore never speak to the surgeon but with a disturbed air; and they remain under this delusion until the operator is able to remove the error. Experience has discovered two other species of patients which require to be well watched. In the first class we place those who doubt not their risk, and who wishing to exhibit a bravado courage, submit themselves, in spite of every one, to the knife of the operator, and pride themselves in supporting the operation without complaint. The second class composes the naturally timid or very susceptible, but who after long hesitation, have become convinced that the operation is absolutely necessary, and collecting all their courage, force themselves to withhold the scream, to resist the most natural sufferings, and to stifle even the slightest complaint. To the first it is necessary to manifest great seriousness on the subject which they appear to treat so lightly and to decide after much reflection. An effort should be made to convince the *second* that an affected courage never supplies the place of real bravery; also, that it is as dangerous to stifle complaints as it is to exaggerate them; that in suppressing them they do violence to nature, which require that the cries of each suffering organ should be expressed freely and without the least restraint. Besides, nothing augers so badly as these forced resolutions and bragging of calmness or resignation. It seems as if nature is weakened by this turning, as it were, on herself, instead of preparing to parry the attacks. The fact is, that operations performed under such circumstances, terminate, generally, less favorably than others.

Internal Injuries.—It would be unprofitable to enter into an investigation of the preparations in relation to injuries of this description, as it would tend to complicate the principal diseases here spoken of. We never attempt any

operation, so long as the patient labors under any formidable functional disease, lest it should prove the means of terminating all the troubles of the human economy. Besides, such injuries should be met as they arise, before or after having decided on an operation. The manner of recognizing and treating them, having been necessarily laid down in books on pathology, it would only be to abuse the patience of the reader to introduce them in a work on operative surgery. The preparations are such as would be demanded by the condition of the patient, in other respects in good health. Upon this point authors are far from agreeing. Some prescribe scarcely a day's regimen, while others do not operate till after having used ptisans, purgatives, revulsives, bleeding or a diet of the greatest rigor—in a word, of the most minute precautions for one or two weeks. Hence, the difficulty of establishing a general rule for all cases. It is in treating on the particular operation, that this question ought to be touched. At present, I will merely remark, that every operation sufficiently important to require a rigid diet for several days afterwards, in order to control general re-action and imperceptibly to change the habits of the patient, require an antiphlogistic regimen, so far as not to debilitate the patient; that the soups and ptisans should be slightly diluted and cooling; and that one or two bleedings either by the lancet or leeches be resorted to. If the patient be robust, a purgative, or at least laxative drinks should be given, in order that the transition be not too sudden and that there remain no germ of morbid derangement in the system, except what follows the operation itself. The preceding considerations ought to apply to *local preparations*. The only thing necessary to be noticed here, is that whatever supports the action of the instruments, the bandages or other dressings ought to be carefully scraped and cleaned.

Place of Operation.—In hospitals, it is customary to remove the patient to the amphitheatre, in order that his companions in misfortune may not witness either his cries or the mutilation he undergoes. This place instituted for the purpose, besides being very commodious, has no other inconvenience than that it is more difficult to warm than an ordinary chamber; and it is the only one which could enable the assistants to witness fully the skill of the operator. It is only used, however, for the capital operations and a few others. Hydrocele, lithotomy, hernia, cataract, fistula lachrymalis and trepan, can, and ought to, be frequently operated on in the hall or even where the patient lies. It is only for lithotomy, amputations and the dissection of certain tumors, that the amphitheatre is indispensably necessary. When the bed room of any patient is not suitable for the operation, we should select some other place more roomy, better lighted, and well ventilated. Here the assistants should be as few as possible, because those who are not actually employed, cause embarrassment almost always, by their indiscreet or ill-timed expressions, by change of countenance, by vitiating the air of the chamber, or by restraint on the patient or operator. The interest of students and of science require the attendance of assistance in hospitals; but here every thing being public, the patients know beforehand what they have to submit to, and resign themselves to it without difficulty.

The assistants deserve the greatest attention, their number cannot be fixed; one being absolutely necessary, the others merely useful. In private practice as few as possible are admitted; while in public institutions all are employed

to whom the operation affords the least advantage. In country practice there is often a great want of assistants. Some of them may not have finished their medical studies; and to those are confided the duties which require only strength, coolness, a little address or intelligence. It is necessary, also, that each should be well acquainted with the duty he has to perform. The surgeon should be careful in making his selection in regard to the ability, sagacity, stature and strength of those he entrusts; and as far as possible to take his assistants from the students accustomed to his practice, who can divine his thoughts at the least sign, and who have at heart the success of the operation, and the triumph of his labors.

The *appareil* or apparatus, is another point that should not be overlooked. The materials which compose it are naturally divided into three orders. The first, such as the garotte, tourniquet, pads, compresses, &c, are intended to prevent accidents during the operation; the second embraces all that is necessary to perform it, and the third relates entirely to the dressings. There should be in readiness, a sufficient number of flexible wax candles, rather than lighted candles, in the event of the natural light not being sufficient; 2d, a chaffing dish full of coals and cauteries; 3d, a little wine, vinegar, cologne and brandy in separate vessels; 4th, tepid and cold water, basins and sponges; 5th, the means of suspending temporarily the flow of blood in the parts about to undergo the operation; 6th, several compresses, lint, ordinary bandages, napkins to dress the patient or protect certain organs. The second series comprehend the different instruments; such as bistouries, knives, needles, scissors, saws, ligatures, nippers, pincers, &c, which are placed on a waiter or table in the order in which they are to be used. The fillets, pledgets, compresses, bandages and other dressings, are disposed on another table so as to be at hand without confusion, when they are required for use. Being about to recur to these details in treating of many operations, such as amputations and aneurism among others, where their utility will be more fully developed, it is unnecessary at present to enlarge on their advantages.

2d. *During the Operation*—The situation of the patient, of the surgeon and his assistants, necessarily governed by the character of the operation, the diseased organ and the taste of the operator, cannot be indicated more advantageously than by describing each article. The same may be said of the hemostatic means, either provisional or definite, of whatever is intended to moderate pain, of the resources besides which have been mentioned under the article "amputation."

3. *After the Operation.*—It is also important that care should be taken to prevent syncope, convulsive movements or spasms, and in fact every attack which may follow the operation. Being obliged to pass in review these various chapters, so that the dressings, the question of knowing if the operation will unite by the first intention, the accidents to which operations are principally exposed, and also the elementary points in the removal of members, and of aneurism, it would be a waste of time to describe them here. I shall, however, not stop to discuss the propriety of the ancient adage "*cito tuto et jucunde,*" which formerly re-echoed throughout the schools.* To say that an

*This adage belongs to Ascepiades and not Celsus to whom it has been attributed. Hippocrates and Galen say: *Celerite, jucunde, prompte, et eleganter* which amounts to the same.

operation should be conducted with promptitude, ability, and address, is a truism which there is no occasion to repeat in our day: the most important part is not to sacrifice one of these advantages to the other; to look immediately to the mind, and to show for example, that promptitude is neither precipitation nor swiftness; but in surgery that *safety and care* should reign paramount.

Phlebites or purulent Absorption.—The division of tissues by the hand of the operator creates sometimes such a series of symptoms, which in latter times has so much occupied the minds of scientific men, that it is impossible to avoid entering upon its discussion more fully. The progress of disease in similar cases is besides extremely variable; sometimes it commences with a violent trembling that may continue for many hours, sometimes by spasms, and, in certain cases, simply by a coldness of the extremities. The skin becomes pale, takes a yellowish tint, somewhat livid, and soon after an aspect more or less ghastly. To the difference of intermittent fevers produced from low grounds, marshy places which have more than one trait of analogy, this first period is rarely followed by a free re-action. If perspiration succeeds, it is unequal, often clammy or heavy; after being renewed once or oftener under the shape of paroxysms, these symptoms are generally followed by remarkable adynamia and mortification. The eyes are sunk and covered with greyish rheum, the conjunctiva becomes yellow, as well as the compass of the lips, and the whole face remains more or less dull. The tongue which is habitually moist, without being very large or pointed, as is the case in intestinal affections, does not become, furred until at an advanced period of the disease; the teeth and the lips become fuliginous. The pulse assumes a frequency and hardness without being quick; and becomes by degrees more and more small and feeble. Distention of the abdomen, sometimes diarrhea, (seldom delirium although nearly always stupor) scarcely ever fail to exhibit themselves.

To these are to be added the indefinite symptoms of visceral inflammation; it appears occasionally as a livid redness of the cheek, which may be remarked for a moment, at the same time accompained by a slight cough or pain in the breast, and difficulty of respiration; sometimes as a jaundice, more or less developed, with pain and derangement in the hepatic region or in the right shoulder; likewise, with what is more rare, a desire to vomit; with a particular redness of the lips and the borders of the tongue, which then becomes dry, as in cases of follicular ulceration of the intestines or of typhoid fevers; as well, in fine, as by acute suffering in some part of the members of the body —the great joints for example. Thirst, is not generally very great; the breath, often fetid, exhales sometimes the true odor of pus; the process of cicatrization is immediately suspended in the wound, the borders of which become pale the same as the rest of the surface. However thick or creamy it might have been, the suppuration becomes all at once greyish, clotted, or resembling ill conditioned serous matter. It is not rare to see it stop suddenly. The soft parts shrink up with the same rapidity, and assume the most cadaverous aspects. The muscles, bones, &c., fall asunder, as if the cellular tissue which unites them in the normal state had been destroyed; after a while a bloody oozing ensues, which becomes more and more fluid until it terminates, when the malady has lasted a long time, by resembling the washings of meat, and produces hemorrhages which nothing can arrest. In

fine, the subject dies exhausted on the twelfth, thirteenth, or fourteenth day.*

Pathological Anatomy.—Upon the opening of dead bodies, lesions of different sorts are found, although susceptible of being all traced to the same cause; these are often the seats of multiplied abscesses, in the proper tissue of the viscera, or collections more or less abundant of greyish cream colored serosity, rather than flakes floating in the serous cavities. Among others the large articulations, such as the shoulder, the hip, the knee, are equally filled with pus, which is supplied frequently, either by the state of the parts or by infiltration, particularly when there is a sufficient quantity of lax cellular tissue. The arteries are almost empty, and the blood which they contain is in general very fluid; that of the veins, which is more abundant, is still more evidently altered. The clots which are found here and there, are a mixture of black, yellow, white and green, and have a granulated texture, which escapes in cutting or even in pressing them under the fingers. They contain sometimes globules of pus, obvious to the naked eye. It is not even rare to meet with the true purulent foci in small clots of blood. All the parts of the venous system have offered specimens of this description; as, for instance, the iliac and uterine veins, the vena-cava inferior below the liver, and at its entrance into the right auricle, the vena-cava superior, the different cavities of the heart, &c. Many of these concretions are yet soft and evidently of recent origin, others, on the contrary, are so dry and brittle that it is impossible to deny them a certain age. Not one of them has, in a majority of cases, a pathological relation to the state of vessels in the region in which it is found. It is entirely different, in the case of wounds, where nothing is more common than to see the veins inflamed, in full suppuration, either interiorly or exteriorly, and that to an extent extremely variable, but of such a description, however, that the two venæ-cavæ remain in almost every instance unaffected.

The small abscesses of which I have spoken in the commencement, have been observed in all the organs. A subject which I had occasion to examine at Tours, in 1808, presented them by dozens in the brain and in the tissues of the heart. A young man who died at the Clinique of the faculty, in 1825, from the effect of amputation of the great toe, exhibited them even in the spleen and in the kidneys. The lungs and the liver, are not less subject to them. It is there that at all times it has been known to exist when no trace whatever could be found elsewhere. Their characters are so well marked, that it is difficult to confound them with the results of ordinary inflammation. Besides, they are seldom developed singly, but much oftener a large number exist in the same part. The surface of the organs appears to be more congenial to them, than deep seated parts; and it is rare that they acquire any great size. In this point of view they vary from the size of a pin's head, to that of a walnut or of a small egg. By pressing upon them they can be distinguished as so many large tubercles reaching across the pulmonary apparatus, the periphery of which seems quite superficial. In the liver they are enveloped in a blackish or livid couche, sometimes several lines in thickness. In this organ they are situated most commonly near the centre, and are generally of

* In the text it is the twelfth, thirtieth, or fortieth day. Tr.

a larger size than in the other parenchymæ. The matter of which they are formed is also more irregular. Although generally very fluid, blue, and flaky, or of a milky whiteness near the centre, they are very often grumous or even hard especially near the circumference. In the lungs we may witness the various phases of this affection still better. At some points may be discovered slight stains resembling ecchymosis. In others we see these stains or blotches inclosing a drop of pus. Again, no ecchymosis exists, and nothing but grumous pus is to be found. Still further we meet with others either concrete like the caseous tubercles of lymphatic ganglions, or liquid as in the liver. The substance of some seems to be confounded with the neighboring tissues. Others are as if encysted. Then the walls of the sac are villous and of a lilac color. At some lines distance from them the organ recovers all the attributes of its normal state. They are almost always separated by interval completely healthy. Frequently it appears after evacuating the matter and removing the cyst as if the organ had never been diseased, or as if the places of the disease had been formed mechanically by a separation of the tissues.

The effusion in the serous cavities is also very remarkable. The pleura is generally its seat although it may also take place in the pericardium, peritoneum, arachnoid membrane, &c. In a few days it becomes very abundant. Without scarcely any alteration the membrane after being emptied, remains covered with a greater or less thickness of true pus, and the residue of the liquid, of an ashy or earthy appearance, is far from resembling the flaky or lactescent serosity which is found as a sequence of recent pleurisy. The state of the tissues in the articulations is astonishing. Neither the cartilages, the capsules, the ligaments, the cellular envelope, nor any thing, in a word, presents the least trace of inflammation, and after removal of the pus a simple lavation has been sufficient more than once to cause doubt whether or not the articulation had been diseased. It may even happen that the cartilages may be partially destroyed, the synovial membrane and the ligaments pierced without the contiguous parts losing any of their mobility or natural color. The same may be said of the sub-cutaneous and other deposites in the extremities. In other cases these deposits are surrounded by ecchymosis and more or less evident traces of inflammation.

Although some patients die with all these varieties at once, imbibing pus as it were like a sponge, the greatest number exhibit only a part of them. Sometimes they are tubercle-like as in the lungs or liver, without any effusion. Sometimes collection in the pleura exists alone; in another case this may be found in the extremities, within or without the articulations; in many cases it will be found no where, and then we must seek the cause of death in the more or less serious alteration of the blood in the vessels themselves.

Etiology.—Every solution of continuity that suppurates, may produce the alterations that we have just spoken of: trepaning, a simple incision, the section of a varix, an ordinary venesection, as well as the amputation of the neck of the womb, the excision of hemorrhoidal tumors, or the amputation of a member. Nor is this a discovery of the present day. Pare mentioned it, and Pigrai says, that in a certain year almost all that died of wounds of the head had abscesses of the liver. Morgagni describes these affections with some detail, Quesnay, Col. de Villars formally mentions them. J. L. Petit

gives a very correct idea of them, and many modern surgeons have noticed them in their lectures or their writings, but they had not then fixed the attention of the profession so strongly to their importance as they now do. In saying that the pus was transported from the wound to the organ in which it was found deposited, the ancients merely reiterated their usual humoral hypothesis and proved nothing To believe as MM. Boyer, Roux, and Dupuytren did, that so many disorders result from simple idiopathic inflammation, caused itself by the sympathetic *(retentisment)* of the wounded part upon the viscera, or by the anterior existence of tubercles or other organic lesion unappreciable until then, was not likely to excite a very lively interest in the question. Struck at the commencement of my medical studies with the frequence and importance of these affections I soon made them the object of my special attention. Believing from a fact observed in the hospital of Tours in 1818, that I had discovered the true etiology, and confirmed in this opinion by what I afterwards met either in Tours or Paris, I took the liberty of publishing it in my public lectures in 1821 and 1822, and in my *Thesis de Reception* in 1823. I then maintained that these numerous purulent deposites owed their existence not to any separate idiopathic phlegmasia, but to an alteration of the blood, to the passage of pus into the circulation and its transport into these organs, whether it came from the wound or was secreted by the neighboring veins. It required some boldness to advance such idea then whilst solidism reigned triumphant over our schools, from which the partisans of the physiological doctrine thought they had for ever banished humoralism. These ideas were therefore badly received generally. Yet my own conviction and the facts that came daily to their support did not permit me to abandon them. My sojourn at the hospital *de Perfectionnement* furnished me numerous occasions to submit them to new proofs, to call them to the attention of the students, and to show in what manner they might enlarge the field of general pathology. The two memoirs that I published in 1826 in the Review upon this subject, and that which I had already said in the same journal in treating of the alteration of the fluids; that which I had advanced at the same time, or soon after, in the *Archives* and *La Clinique des Hospitaux*, and the discussions that I caused in the Academy finally had its effect, and I soon had the satisfaction to see that Marechal and Raymond of Marseilles, in their excellent thesis (1828) and M. Legallois in a memoir at the same time had arrived at the same conclusions that I did. Whilst M. Dance in a work still more complete, was removing the last vestiges of objection, opinions supported by facts of the same kind were taught at London by MM. Rose and Arnott. M. Blandin, who in a thesis a little later than mine (1824) had adopted the hypothesis of sympathetic reaction and pure simple inflammation—MM. Tonnele and M. Rochoux have ranged themselves under the same flag although their theoretical views are not exactly alike. In fine, the pathological meeting which took place at the Faculte de Medicine in the spring of 1831, having called in MM. Berard, Blandin, Sanson, and myself, to examine the question of metastatic suppurations following traumatic lesions, has in a manner forced us to show the present state of opinion upon this subject, and to prove that there can be no further difference of opinion upon the principle with which I set out, viz. that *metastatic abscesses caused by great operations are the result of an alteration of the blood.*

There is still, however, a problem to solve. Marechal, Legallois, and Rochoux, found in the absorption of the pus of the wound a sufficient explanation of all the observed phenomena. Dance, Arnott, and Blandin on the contrary thought that an inflammation of the veins always preceded the general infection, and that the pus which entered into the circulation was always the immediate product of phlebetis, which M. Blandin located in the veinules of the soft parts, the medullary canal, or the spongy tissue of the divided bone, when the primitive branches offered no traces of the affection. Instead of admitting a transport without decomposition, a true metastatic deposite, the latter authors think also that the blood, profoundly altered by its intimate intermixture with the pathological secretion, and becoming more irritating than common, is simply permitted to escape here and there; and being deposited in the tissues, by their irritation become the centre of so many points of suppuration. This opinion differs from mine only in this, that it gives a cause as the constant one, which I think exists only in certain cases. Nor can I comprehend how any one can expect to make use of the labors and opinions of MM. Dance and Blandin to combat mine. In fact, so far from denying phlebetis in such cases, I expressly said in 1826, (Rev. Med. tom. 4) "the veins of the diseased member are full of a very fluid greyish pus, and inflamed from point to point, but only as far as the entrance of the great saphena into the crural." Again, I added, "the phlebetis was not sufficiently extensive; if it were even primitive to play an important part *as inflammation*. In turning our attention towards the fluids, on the contrary, every thing explains itself in the clearest manner," &c. In May 1827, I asserted (Clinique des Hopit,) that "in this frightful affection authors have paid attention only to one cause of danger; the facility with which the inflammation is propagated from the wounded point towards the principal veinous trunks; whilst the pus secreted by the walls of the vessels continually mingles with the blood which it alters and decomposes, and thereby produces all the danger of the disease." Finally, in speaking of the same fact in the Archives (August 1827,) I said, "here the disease was incontestably a phlebetis; but it is to the inflammation of the vein that we must attribute all the symptoms. I think not: the pus continually entering the heart and distributed to every organ with the blood has produced the general affection," &c. As to the formation of the purulent collections, this is my theory which I gave in 1826, (Rev. Med., tom. 4.) "It is possible to explain the formation of these collections by two processes; 1st, the blood more or less changed from its natural condition, may commence by deranging the general organism, and terminate by the formation of a local phlegmasia of a peculiar species; or, 2d, the inflammation at first developed under the influence of ordinary causes compels pus in a manner to be deposited at the point of the greatest irritation. It appears to me demonstrated that the inflammation when it follows the deposition is then only secondary, and that it is produced by an extravasated portion of foreign matter, which forms the point, and that this is at least a phlegmasia *altogether sui generis*," &c.

Thus, in my opinion, the question may be reduced under two heads; 1st, the mixture of pus with the blood as the cause of the observed visceral alterations; 2d, the origin of the pus whether in the blood or in the organs. The first, of which I was the first to venture on the demonstration of its truth, is

now generally admitted as incontestable. For the other I have not felt the same interest it is true. The object of my efforts being to prove that the pus could circulate with the blood, and infect the system like a poison, I cared little at the moment about proving whether it penetrated into the veins by absorption or was simply formed on the inflamed surface of these canals, provided it was admitted to be transported a certain distance from the point of departure. The preceding quotations, however, are sufficient to show that I had not altogether neglected these secondary questions. The effect of phlebetis upon the composition of the blood are so evident that it appeared to me superfluous to enter into any detail for their exhibition. The same cannot be said of absorption, as many yet refuse to admit it; it is, therefore, after leaving this part of the question, that a real difference seems to exist between M. Dance and myself. According to this author, the phlebetis is the first and almost only cause of these metastatic *foci*, and the veins alone secrete the pus that alters the blood. On the contrary, I said at first, as I believe now, that the inflammation of the veins so often met with, whether cause or effect, were not indispensable; that the pus and other morbid matters of the traumatic surface enters sometimes into the circulation, either by lymphatic absorption, by imbibition, or by the orifices of the veins remaining patulent at the amputated surface. The proof of its truth, in my opinion, is, that I have frequently found abundance of pus in the midst of the viscera although the veins plunging into the exterior lesion were scarcely phlogosed, and without any trace of phlebetis at any other point of their whole course. And since the possibility of this has been denied, I have proven it upon thirteen subjects; among others, in a woman who died in consequence of a serious traumatic lesion of the foot at the hospital *Saint Antoine* in 1829, who was opened in presence of M. Dezeimeris, an avowed partizan of M. Dance's ideas; and again, upon one of the wounded heroes of July, who died on the twentieth day of an amputation of the thigh in 1830, at la Pitie, in which I exhibited the total absence of phlebetis to M. Berard, who had also adopted the hypothesis of veinous phlegmasia as the first cause of metastatic abscesses.

As to the *mechanism* of these abscesses themselves, I said that the pus traversing the tissues might be deposited naturally, or by its presence irritate several points of the viscera, and thus form so many phlegmasial and purulent foci. M. Dance rejects the first of these two modes, and seems even to deny its possibility. With all the reasoning and objections that he produces, I cannot submit to his opinion. If he thinks that the blood, rendered more fluid and altered by the pus, begins always by producing a small echymosis, and soon after a true inflammation, before producing an abscess—a mechanism that I have pointed out myself for the majority of cases—then he has not seen, as I have, these foci, not larger than a hemp seed, in the head, the spleen, the kidneys, the lungs, and the liver, and around which the most attentive and minute examination, did not enable me to discover the least lesion of the organic elements; nor those purulent collections that I have so frequently met with in the cellular tissues or certain articulations, and which after evacuation and lavation, leaves not the least trace of their existence. If the little veins around each purulent focus are sometimes inflamed it is certainly erroneous to say that they are always so, and we may admit the capillary phlebetis pointed out by M. Cruveilher as happening in similar cases. Moreover, if we

admit the deposition of one molecule of morbid matter, we cannot refuse to admit that there may be a great number. The pus mingled with the blood is a heterogeneous matter, which tends continually to escape by one way or another. Whilst it is inclosed in the large vessels, and the circulation has lost nothing of its activity it injures nothing; but in the capillary system where the movement of the fluids are only a sort of oscillation, where are produced nutrition, the various secretions, a thousand new combinations, compositions, and decompositions, must not its elements make some efforts to agglomerate, to reunite, and cease to flow with the other fluids? This chemical aggregation made, will it not constitute a centre of attraction for other similar molecules? Is any thing else necessary to determine the seat of an abscess? There is nothing in this more difficult to comprehend than in the formation of bile, urine, saliva, or mucus. These are natural secretions and exhalations; that on the contrary, is a pathologic secretion or exhalation. This is all the difference.

Prognostic.—Let the matter be explained as it may, these metastatic collections, are the effect of serious operations, and always produced by the passage of a certain quantity of pus into the general circulation; and thereby justifying an extremely unfavorable prognostication. The name *tuberculous* that I first gave these collections, related to their form, and I am astonished that any person should have attributed to me the idea of comparing them to the tubercles of the lungs under any other aspect. The silent and often rapid march of these lesions rarely permits us to detect them in their origin, and when at last the fact of their existence is no longer doubtful, they are generally beyond the reach of art. As soon as the surgeon discovers the existence of violent chills with alteration in the expression of the face, a continued fever, whether attended or not by pains in certain parts of the body, or whether following or not following a diarrhea, in a patient recently operated upon, or who is suffering from an extensive suppuration of any kind, attended with traumatic lesion, he may expect the most serious consequences and fear that death will be the inevitable termination. Yet, if such phenomena exist only for two or three days, and at the end of this time a general sweat or some other critical evacuation extinguishes the fever and calms the above mentioned organic derangements, he will have some cause to hope. I have seen persons recover after having had the true shiverings as well as other symptoms of a purulent infection. The examples are rare, it is true, but they have occurred, and the surgeon should not forget them.

The mode of *treatment* is yet unsettled. Sanguinary evacuations either by phlebotomy, leeching, or cupping, is only applicable in the onset of the disease, and in robust and plethoric cases, unless there be some pain or well determined local inflammation; I have seen them used and pushed as far as possible in a number of cases without discovering any sensible advantages. Those who have suffered from hemorrhage either of the wound or the mucous surfaces were not more fortunate. Purgatives administered early, have appeared to me to succeed sometimes. Vesication either of the thighs, legs, or painful parts of the chest or abdomen, deserves to be remembered. Nor is the sulphate of quinine without some utility when there are any intermissions and the stomach not too irritable. Tartrite of antimony, in large doses, first recommended by Laennec, and since by M. Sanson, did not prevent the death

of three patients on whom I tried it. As to the preparations of opium, camphor, ether, ammonia, and other diffusible and exciting substances, they have always appeared to me to increase the symptoms, and hasten the fatal termination.

Finally, when the derangements above indicated manifest themselves, every exertion should be made to attract the fluids towards the wound. If it be an amputation, it should be first enveloped night and morning in a large linseed cataplasm, applied naked to the skin. At the same time, one or more blisters are to be applied to the legs, and a light warm infusion of linden or elder prescribed as a drink. A bleeding to the extent of eight or ten ounces if the pulse has sufficient force, or the patient be not already too weak. If the wound be very pale and the tissues have lost their consistency, it will be necessary at each dressing to make use of a lotion strongly charged with cinchona, and then cover it with a pledget of storax or of balsam d'Arcœus, mixed with cerate. A blister to the stump, scarification, and leeching, if there be at the onset any swelling, inflammation, or external evidence of phlebetis, will be indicated. Compression by means of a roller from the origin of the member towards the solution of continuity should also be tried if the disease has not affected the system and is still local. After these Seidlitz water may be administered as a purgative if the tongue continue soft and not red. The stimulant emetic should only be used afterwards, when stupor, swelling of the abdomen, and a fuliginous state of the mouth have made their appearance. Cinchona, either in decoction or substance, is only to be used in well marked adynamia. Gum, and rice water should be combined with it when diarrhea exists, or when the digestive tube seems disposed to revolt against it. The sulphate of quinine in a dose of five or eight grains at the termination of each paroxysm will answer better if there be intermission and sweat. The drinks must be varied according to the predominating symptoms and the taste of the patient. Such as lemonade, decoction of tamarinds, &c., if the thirst be great, or light bitter aromatic infusions in the contrary case. The decoctions of rice, barley, ratany, the white decoction, disascordium, gum kino catechu, or extract of ratany are no longer to be dispensed with when the alvine evacuations are frequent and threatening to the patient. In a word, the whole of this treatment being exactly the same as that for phlebetis, and the absorption of pus in general can only be incompletely exposed here. The details must be sought in the treatises on pathology. I have only felt it necessary to give a summary, such as was indispensable to excite the solicitude of the surgeon, and premonish him against the dangers of a false security in the therepeutics whose efficacy is still so uncertain.

NEW ELEMENTS

OF

OPERATIVE SURGERY.

ELEMENTARY OPERATIONS.

The greater number of operations are made up of several separate steps, each of which often constitutes in itself a distinct operation. Throughout operative surgery are found, incisions, dilatations, extractions, and reunions, whether separate or variously combined. As dilatation and extraction require in each of the particular operations in which they are practised different instruments or processes, it would be superfluous to examine them here as general indications. But, there are few operations which do not begin by a *division*, or do not end in a *reunion*. I have thought it best therefore to begin by saying a few words of diaræsis and syntheses.

CHAPTER I.

DIVISIONS.

SECTION I.

Cutting Instruments.

Laying aside laceration, pulling out, and rupture, which nevertheless are also divisions, diæresis requires no other agents than the bistoury, the scissors, and certain instruments designed to answer particular indications.

ARTICLE I.

Manner of Holding the Bistoury.

The bistoury is of itself worth all the rest of the surgeon's armory. If it were absolutely necessary, it could supply the place of all other cutting instruments. To use it skillfully then, is an art which the surgeon should make it his first endeavor to acquire. There are three principal ways of holding the instrument; first as a table knife, secondly as you would hold a

pen, and thirdly as a drill-bow. Each of these modes presents varieties which I intend briefly to point out, giving to each the name of position.

FIRST POSITION.

Bistoury held as a Knife, the Edge downwards.

In this, which is the most frequent position, the handle of the instrument enclosed in the palm of the hand, and retained there by the ring and little fingers, is pressed on either side by the thumb and middle finger, at the junction of the blade with the handle, whilst the fore-finger rests upon the back of the blade: thus held, it presents the utmost firmness and security, and it can be guided in every possible direction; if it is necessary to employ much force, to cut into solid tissue, to cut out large flaps or vast and indurated tumors, or to pair off some dense excrescence, nothing would be easier than to bring the middle and index fingers before the others, upon the side of the handle, and to hold the instrument in full grasp.

SECOND POSITION.

Bistoury held as a Knife, the Edge upwards.

Instead of being held towards the tissues, as in the preceding position, the edge of the bistoury should be sometimes turned in the contrary direction. In that case, the front and not the back part of the handle is pressed against the palm of the hand, and the thumb with the fore-finger presses the sides, while the middle is beneath the handle with the third and little fingers. Thus, turned upwards, or in the direction of the back of the hand, it is in the best position for cutting from within outwards, in certain cases where more force than celerity is required in the movement.

THIRD POSITION.

Bistoury held as a Pen, the Edge downwards and the Point forwards.

In this position the handle of the bistoury passes from the back of the hand on the radial side of the first metacarpal bone, to be held as in the first position by the thumb and the first two fingers. The remaining fingers are left free to find some point of rest near the part to be divided.

FOURTH POSITION.

Bistoury held as a Pen, the Point backwards.

If the edge of the instrument be turned towards the tissue, and the point directed forwards, it will be found to be held exactly in the same manner as a pen, and this is the characteristic of the preceding position.

Manner of Holding the Bistoury.

But, in the fourth position, the middle finger is pushed forwards on one side of the blade, and then flexed, turning the point of the instrument by this

motion towards the body or wrist of the operator, so that its edge looks towards the palm of the hand, from which it is separated by a triangular space varying in the dimensions of its posterior base. The greater part of delicate incisions and dissections require the first mode; the second is more applicable when it is necessary to pierce some deep part, and cut outwards from the puncture.

FIFTH POSITION.

Bistoury held as a Pen, the Edge upwards.

To dissect or to cut forwards, in order to enlarge certain openings which are deeply situated, we are often obliged to change the position of the edge of the bistoury, and turn it in the same direction with the dorsel aspect of the hand, and to present the back towards the palmar side; and except that it is necessary to substitute the index for the middle finger, the instrument may be held with the point either forwards or towards the wrist of the operator, as the fingers may be flexed or extended, and as it may be desirable to carry a continued incision, or merely to divide attachments.

SIXTH POSITION.

Bistoury held as a Drill-bow.

The sixth position holds in some sort a middle place between the first and the second. As in the one, the handle of the instrument rests on the interior of the hand, and as in the other, it is held only by the ends of the fingers. This mode differs nevertheless from both in the fact, that with regard to the axis of the fore-arm, the bistoury is held in a horizontal plane, and that the pulp of the extended fingers supports it on one side, whilst the thumb is applied upon the other. The three varieties of this position are easily distinguished. In *the first*, the edge of the bistoury looks downwards. In *the second* variety, which approaches nearer to the *second position*, it is turned upwards, and in *the third*, it is turned to the right or the left, while, instead of holding the handle by its flat faces, the fingers and the thumb press against the back and front. The first of these positions, giving facility to light and delicate strokes, is particularly indicated in scarifications, such as of inflammatory erysipelas, where we have decided to operate by incisions, and also for laying open large subcutaneous abscesses. Recourse is rarely had to the *second position*, unless for the purpose of cutting small lamellæ, guiding the bistoury along the groove of a director. The utility of the *third position* also, is only acknowledged in a small number of cases, when, for fear of wounding some subjacent organs, it is thought necessary to cut horizontally by successive laminæ, as in the operation of planing.

Manner of holding the Scissors.

The manner of holding the scissors is familiar to all. It is not necessary for me to point it out. I will only say, that instead of the index or middle finger, the fourth or little finger and the thumb should hold the rings of the instrument; the two first fingers being placed before, either about the handles, or upon one of the flat faces, add to the firmness and precision of the movements. The use of knives, or of particular bistouries, will not be described except in connexion with the operations which require them.

SECTION II.

Different Kinds of Incisions.

All incisions are made in one or other of two general modes, the definition of which will serve as a principle of classification. The first class of incisions consists of those which are made from the skin towards the deep parts, and is called from without inwards; the other class, are those which are made from the midst of the organs towards the exterior, and are called incisions from within outwards. The choice of the first or second of these modes must be decided by a variety of circumstances, which will in their proper order be developed in the sequel, and which will, in the discussion of the opening of abscesses, be in a great measure recapitulated. Whichever method is adopted, incision is practiced: first, towards the operator; secondly, from the operator; thirdly, from *left to right*, when the handle or point of the bistoury is directed either immediately across, or obliquely backwards and outwards with the right hand, the fingers bent, and the wrist or fore-arm previously extended; fourthly, from *right to left*, if with the same conditions, the left hand is used. The direction from *left to right* being the most natural, is of course the most usually followed, so that the others might strictly be ranked amongst the exceptions, and are at least not so frequently indispensable. A single or *simple* incision, is that which is made in the same direction throughout, and which can be terminated by a single stroke of the bistoury. It is nearly always made to the right; and, by repetition and combination varied in a thousand ways, gives rise to those complex and multiplied incisions, whose forms, heretofore so various, are now reduced to the V, the T, the +, the ellipse, the oval, the crescent, and the L.

Art. 1.—*Simple Incisions.*

Direction.—In the absence of special indication, the incision should be parallel; first, to the greatest diameter of the part; secondly, to the direction of the arteries, the large veins, or the principal nerves; thirdly, to the direction of the fleshy fibres, the muscular masses of the tendons; fourthly, to the natural folds of the teguments; or, fifthly, to the great axis of the tumor.

On the dorsal and plantar surfaces, and on the sides of the foot, about the knee, before, behind, and on the outside of the thigh, it is made in a direction parallel to the axis of the limb, because the vessels, the nerves, the muscles, and the tendons there have mostly that direction. Behind the ankles it is made somewhat concave forwards, because in this part the same organs are necessarily somewhat curved in order to reach the sole of the foot; on the inner side of the thigh it should be oblique, to correspond with the course of the muscles of the leg, of the saphena vein, or of the femoral artery; in the groin it is never made in the direction of the great furrow of that part, except when they are intended to go no deeper than the subcutaneous cellular tissue.

On the breech the muscles serve as guides, and the same is true on the sides of abdomen, while before and behind this cavity, the incision should follow the axis of the body; the chest requires the observation of the same rules, except towards the arm-pit, where it is better to follow the axis of the trunk than the fibres of the serratus. In the hand, reference should be had to the wrinkles of the palm, and in the bend of the arm, to the arrangement

of the veins, muscles, or arteries, rather than to the axis of the limb. About the neck incisions should correspond in direction with the muscles, the vessels, or the axis of the part, as the circumstances of each case may require; and it is seldom or never right to cut directly across, except in the bottom of the fossa, above the collar bone. On the cranium they should be parallel to the muscles, or the principal arteries. About the eye-lids they should be made in a semilunar curve, concave towards the eye, to correspond with the muscles, the wrinkles, and the arteries: it is much the same with the lips. They should be straight on the nose, and oblique in this or that direction upon the other parts of the face, according to the wrinkles on which they fall, or to the vessels or the muscles over which they are to pass. Lastly, on the ear the projections of that organ should regulate the direction of the incision.

The nature, the comparative depth, and the form of the disease are the only circumstances which can justify an infringement of these rules.

Stretching the Skin.—There are several ways of fixing the skin in order to make a simple incision.

1st. With the cubital side of the *left hand,* the thumb acting in the opposite direction.

2d. By grasping the part underneath with the whole hand.

3d. With the extremity of the four fingers placed in a line parallel to that in which the bistoury is to pass.

4th. By taking up a fold of the integuments.

5th. Causing the tissues to be stretched by assistants in order to keep both hands free.

6th. In drawing on one side whilst the assistant pulls the integuments towards the other.

With the thumb and little finger the part must be accurately supported, and the tension is seldom equal on every point, unless we use the assistance of the index and even that of the two other fingers. *To grasp the organ* is a method which can only be applied to limbs, or to certain tumors which are very prominent or pendulous.

With the ends of the fingers the skin is firmly fixed, and the nails give support to the instrument, but the tension is incomplete, and is only made on one side. To take up a fold of the integuments is only proper in a few cases, and is not always practicable. *The hands of assistants* or of one assistant are never so safe as that of the operator himself, and should never be put in requisition, except in cutting around, or on the surface of tumors, and large masses of flesh; the first mode is therefore the best, and it is for the surgeon to decide under what circumstances it will be necessary to resort to either of the others.

§ 1. *Incisions from Without Inwards.*

To cut from without inwards, the bistoury may be held in the first, third, or sixth position, according to the degree of force to be employed, the situation of the disease, or the extent to which the incision is to be carried. The convex bistoury which, all things being equal, cuts better and with less pain, has nevertheless the inconvenience of leaving, more commonly than other kinds of bistoury, portions at the two extremities of the incision imperfectly divided, and is ill adapted to operations somewhat delicate, which pass deeper than the skin, and to incisions made upon excavated surfaces, and require that the instrument should act principally with the point. The straight bistoury, though less rapid in the commencement of the incision, is nevertheless afterwards incomparably

in the commencement of the incision, is nevertheless afterwards incomparably more convenient, and could strictly be substituted for the other in every case.

In the first position the convex bistoury is rested with the most prominent point of the blade on the middle of the space supported by the thumb and fore-finger, and then drawn from left to right, as far as the point where the incision is to terminate, so as to divide the entire thickness of the skin at the first sweep, and even deeper still if no important organ be situated beneath. In order to leave as small a trace as possible imperfectly divided, care should be taken to apply the instrument with firmness in the beginning, and to raise the wrist in terminating the incision. Held in the third position the bistoury will cut more with the extremity than with the prominence of the blade, and will be less likely to wound or injure the parts beneath, or to leave long traces at the ends of the incision, but it loses much of its lightness and of its other advantages. In the sixth, it cuts like a razor, dividing with ease the finest and softest layers, as well as the thickest and most tense, but its stroke wants firmness, and seems like cutting upon air.

The straight bistoury, held in the first position, pressed like the other, and drawn and withdrawn in the same manner, acts principally with the point. It does not penetrate so well, but cuts more equally and leaves scarcely a trace not fully divided. In the third position, the point should be sunk, by puncture, to the intended depth of the incision, the hand being raised for that purpose: in continuing the incision, the wrist should be brought down by degrees, but again elevated at the end of the operation, so that the edge may be at that point perpendicular to the surface cut. The whole process begins with a motion like that of a scale-beam descending, and ends with a corresponding motion upwards. In this position, the little finger, placed on the right of the incision, serves as a support for the hand, and gives steadiness and security to the successive stages of the operation.

Lastly, when held in the sixth position, the straight bistoury acts in the same way as the convex when held in the same manner; with this difference, that it does not penetrate so quickly nor so well.

§ 2. *Incisions from Within Outwards.*

An incision of this class is sometimes made without the aid of a conductor, at other times with; sometimes with the bistoury, and sometimes with the scissors; sometimes in a part yet undivided, and sometimes through a previous division.

Without the conductor, with the bistoury—without a *previous division*, incisions are made either towards or from the operator. When the incision is made, the instrument is held in the second position and entered by puncture, after which the wrist is quickly raised, so that the bistoury may divide the tissues from its heel to the point, acting as a lever of the second kind; or else we raise the point by depressing the hand, so as to pierce the skin a second time, and finish by drawing the bistoury towards the operator with the edge upwards. so as to divide the parts between the points of the entry and exit of the instrument, causing it to move as a lever of the third class. When the incision is made in a direction *towards the operator*, the instrument is held in the fourth position, with the ring-finger fixed on the side of the blade at such a distance from the point as properly to limit its progress. It is then entered by puncture, and when it has penetrated to a sufficient depth, it is rapidly brought to a perpendicular position, acting like a lever of the second class,

§ 3. *Upon a Director.*

When there exists a previous opening, the instrument is passed through that, either towards or from the operator, without a conductor, when this can be easily done; otherwise laid flat on the fore finger, or guided by a grooved director, if the finger would occupy too much space. After this is done, the operation is performed as mentioned above. The director is held in the left hand, like a scale-beam or a lever of the first class, of which the fore-finger placed beneath forms the fulcrum, the thumb upon the plate the power, and the layers which the point tends to elevate the resistance. To glide along the groove with ease, the bistoury must then be held in the second, fourth, or sixth position, with the edge upwards. Those which have no *cul de sac*, present no obstacle to the point of the instrument, which then can be passed directly onwards until it emerge by piercing the skin; but where there is a *cul de sac*, the bistoury must be raised as a lever of the second grade. The narrower the bistoury the more easily it advances. The convex bistoury is not adapted to such cases, because its extremity is too large, and its point, depressed too far behind, easily comes against the groove of the director.

After having placed the director, another method may be used; feel for the end of that instrument through the skin, and, having ascertained the point under which it projects, cut upon it by a slight transverse incision, so as to make a counter opening. The point of the instrument, guided by the groove of the conductor, is then slipped towards the handle, or from right to left; or even, without making a previous incision, the point of the bistoury held in the fourth position, may, by puncture, be brought in contact with the director near its beak, and carried in the fourth position rapidly along the groove towards the body of the operator.

In using the scissors you introduce one branch upon the finger, or upon a director, leaving the other on the outside, and then cut from you as briskly as possible all that you design to divide.

§ 4. *With a Fold of the Integuments.*

With timorous or refractory subjects, if the skin is very unsteady or wavering, or if it is desirable not to penetrate beyond it, it is sometimes necessary to take up a fold of it before cutting. This fold, which varies according to the extent to which the incision is to be carried, should be held on one side by an assistant placed in front, and on the other by the operator. It is then divided from its free edge towards its base, as in the incision from without inwards, or by puncture in the contrary direction; that is, passing through from the confined towards the free edge as in making an incision from within outwards. The pressure made upon the integuments in folding them up, deadens their sensibility, and consequently renders the pain less acute. Besides, as the bistoury only pierces the parts like an arrow, there is no risk of failure or embarrassment from the movements of the patient. The objection to this mode of practising incisions is, that there is rather less certainty of giving exactly the suitable extent than in those above described.

§ 5. *Horizontally.*

The horizontal incision is that which is most rarely practised, and only when it is desirable to cut out successively over some one point the various laminæ

concealing an organ, which is to be avoided. The bistoury is then held in the sixth position, with the edge on one side; the left hand armed with fine pincers, lifts up successive layers of tissue, while the right hand shaves off the portions thus raised with the bistoury held horizontally below the *beak* of the forceps.

This kind of incision is almost exclusively reserved for herniotomy, but is yet occasionally used in some other operations, such as those for aneurism.

Art. 2.—Compound Incisions.

Complex incisions, being but a combination of simple ones, are necessarily subject to the same rules of practice, and may in the same manner be executed, from without inwards, or from within outwards, and with or without a director.

1. *The* V *incision* is composed of two straight incisions, which, starting from the same point, terminate at a greater or less distance apart, according to the extent of the triangular space which is to be included between them. The angle should, in the absence of particular counter-indications, be turned towards the lowest part, and the incisions should be made towards and not from that point. The reason of this rule, which at the first glance seems inconsistent with the aim proposed, is, notwithstanding, easily comprehended. If the bistoury were applied to the extremity of the first incision, in order to execute the second, it would press upon or weigh down the edge now deprived of support before it could cut, occasioning more pain than is necessary, and producing a contused and irregular incision. If the convex bistoury were used, there would be the additional inconvenience of making a scratch beyond the external border of the first incision, or leaving the second imperfect near the angle. In beginning at the base of the triangle, no inconvenience of this kind will be sustained. The skin may be as easily held tense for the second incision, as for the first. The bistoury itself stretches it in some measure in approaching the apex of the triangle, which it isolates and completes without difficulty, if the surgeon take the precaution of raising the wrist in finishing. To detach the flap of integuments, which has been limited by such an incision, it must be seized at the point with the pincers, for which it is well to substitute the fore-finger and thumb, as soon as it is practicable. The right hand provided with the straight or convex bistoury (no matter which), is held in the third position when you intend to cut towards yourself, or by bending the fingers; in the fifth position, on the contrary, if you intend to cut *from you*, or by the extension of the fingers; dissect up the flap by free sweeps from below upwards, or from the apex to the base, taking care to raise with it a layer of cellular tissue as thick as possible. Formerly the V incision was thought indispensable in the operation of trepanning the temple; at the present day it is absolutely required nowhere, but is occasionally used in the removal of certain tumors, and in certain disarticulations.

2. *The oval incision*, which will be discussed under the article of Amputations, differs from the incision V in this, that it continues from one branch of that incision to the other, passing round the base of the flap, which is thus completely isolated.

3. *The cross incision* consists, as its name indicates, of two simple incisions which cross each other at right angles. Only the second of these incisions needs to be described. It is commenced at the left side of the first division with the same precautions as in all other straight incisions; but, instead of being carried across without interruption, it is terminated with an elevation of the wrist at the point where it touches the first incision, of which it cuts only the left lip. To complete it the operator changes the position of the bistoury,

unless he prefers to take it in the other hand, and repeats on the right the operation which he has just performed on the left. In short, it is an incision made in two separate steps, of which the two portions, having a common termination, meet in the middle of the first incision ; and which does not allow the instrument to roll or fold under its edge the second lip of the first incision, as it would almost inevitably do in passing from the left to the right, so as to complete the incision at a single stroke.

The dissection of the four triangles which result from this double division, is but a repetition of that which has been already mentioned in speaking of the V incision.

4. *The* T *incision* differs from the crucial incision in but one point, that is, instead of passing on both sides the second incision stops upon the first, forming with it only two right angles ; so that it consists of two cuts, instead of the three, which form the crucial incision. For the rest, the same precautions are to be taken in the division of the tissues and in the dissection of the flaps, and the manner of holding the bistoury is the same in both cases. The crucial incision, and the T incision, being mere modifications of each other, are indicated whenever a straight incision is insufficient to expose the tissues which it is intended to isolate or remove. The relative value of either should be determined by the size of the part to be exposed.

The bistoury, carried flat between the integuments and the tissues beneath, and there turned so as to cut from within outwards, or otherwise, conducted along the groove of a director, would convert a simple straight incision into a complex one, as securely as if it were directed upon the skin cutting from without inwards. This method is indeed sometimes preferred.

The *elliptical incision*, which becomes in almost every case necessary in the operation on a subcutaneous tumor where it is thought proper to remove a portion of the integuments, is formed by the union of two curved incisions. with the concavity of each presented towards the other. To trace out the direction with ink has no other inconvenience than that of being useless, except in certain rare cases, where, by the least deviation of the bistoury, great hazard would be incurred. This is a case where the hand of an assistant is of advantage to hold the skin on one side, whilst the surgeon stretches it upon the other. The rule demands that the lower incision should be first made, so that the bleeding which might be occasioned by the operation should not interfere with the performance of the other. It is made by cutting from left to right, *or towards the operator*, while the assistant raises the tumor, and the operator stretches with the left hand the integuments beneath. This arrangement is reversed in making the second incision ; for here the surgeon himself usually draws towards him or depresses with the ends of his fingers the mass to be excised, while the assistant stretches the skin above, taking care at the same time that this tension is exerted at one time in a transverse and at others in a longitudinal direction, in such a manner that the instrument, carried to the left extremity, or to the upper part of the inferior incision, can make the incision as neatly in the beginning as in the middle of its progress, and will have no folds of skin rolling before it towards the end. It should not be forgotten, moreover, that this *upper incision* being carried above a depressed part, needs but a slight degree of curvature during the passage of the knife to become deeply concave immediately afterwards, when the parts are left to assume their natural position.

Crescentic incision.—Some persons have thought of late, that a double curved incision, with both parts convex in the same direction, could be, in

certain cases, advantageously substituted for an elliptical incision. The crescentic portion which it circumscribes, leaves a wound with a loss of substance, the convex edge of which may be dissected and turned over on its base, so that it can be afterwards applied to the concavity of the other edge, and over the bottom of the hollow left by the operation. Might it not be adopted for the extirpation of extensive tumors where it is possible to preserve nearly all the skin, and where a straight incision would not sufficiently expose the disease? It would afford the same advantages as an elliptical incision, without opposing so strongly an immediate reunion.—The dissection of the flap described by a simple semilunar incision, where no skin is to be removed, may be performed in the manner above described under the T, the V, and the crucial incisions, for which this is frequently substituted. In conclusion, I will add, that by dissecting up the lips of any incision whatever, from the subjacent parts to the extent of an inch or more, according to the wants or situation of the wound, you are often able to cover extensive losses of substances, since the integuments thus raised may be stretched to an astonishing extent, and permit us to bring into contact the borders of an assemblage of wounds which would have been thought incapable of meeting.

The L incision, which is used in exposing some large arteries, as the carotid and subclavian, need not be here described.

Art. 3.—Incisions applied to Abscess—to Collections of Fluids.

It may be boldly asserted that the bistoury is the sovereign remedy for abscesses, whether hot or cold, diffused or circumscribed, vast or inconsiderable. The pain which it produces is nothing in comparison to the accidents which it prevents; and I can scarcely comprehend why it is that its use is so often abstained from, merely because fluctuation continues obscure in the sequel of phlegmonous inflammations. Since it is a very effective means in the treatment of subcutaneous inflammations themselves, suppose even that the sac is not opened, what evil can result from its application? It is a perfectly simple wound, which relieves engorgements, and presents no obstacle to the disappearance of the original malady; but, on the contrary, favors, in almost every case, its progress towards recovery. After having witnessed the ravages secretly committed by the presence of pus, either infiltrated or effused into the organs by the absorption of this fluid, or by its migrations through long tracts of cellular tissue, it is impossible to hesitate between such dangers and the fear of making a useless incision.

Every kind of straight incision is applicable to abscess, the further treatment of which I shall not here discuss. The large abscess lancet, which was formerly thought so indispensable, has entirely fallen into disuse for this half century past. The common lancet, which sometimes takes its place, is insufficient, except for a very few cases; as where the skin is very thin, and the abscess very superficial or small; and even then the bistoury should be preferred, if there were not certain beings occasionally to be found who are terrified at the very name of "bistoury," but who would submit without reluctance to the stab of a lancet.

§ 1. *Incision from Within Outwards.*

There is no circumscribed abscess which cannot be opened from within outwards. The operation is rapid, and gives but little pain; the instrument

penetrates by puncture; its point plays in the interior of the sac, and its edge being raised so as to cut from heel to point, stretches the cutaneous covering as fast as it divides it, instead of pressing it down. In a case of this kind, the straight bistoury is the only one that should be used. It is never held in the fifth position, except to cut *from you* at the bottom of some cavity, as for instance, in certain abscesses in the hollow of the cheek. But it is very frequently used in the second position. When it is thus held, it affords all necessary force and ease; it penetrates with great facility in a direction from the operator with any degree of obliquity that may be desired, and nothing is more simple than to sway it as a lever of the second class, by raising the wrist at the proper moment for terminating the incision. The fourth position is still more convenient; the support which is given to the hand by means of the ring and little fingers, is an advantage which the second does not present in the same degree. The puncture is made towards the surgeon with the hand and fingers flexed; it is only necessary to extend these at the same time that the handle of the bistoury is drawn back to assimilate it to a lever of the second class, as, in the previous case, to make the incision from heel to point, and to divide the outer wall of the abscess through its whole extent with equal firmness and celerity. This is the position which incurs the least risk from inconsiderate movements or refractory behavior in the patient, and I have been long in the habit of using this in preference to the others, where there was no special indication to the contrary. The puncture being made, the remainder of the incision takes place almost spontaneously. Upon occasion, this position will be as convenient as the second for transpiercing through and through a hard or superficial sac, as it is sometimes proper to do in cases of furunculus or anthrax, and of some prominent abscesses on the limbs, covered by an extenuated portion of skin. The best bistoury in such a case, and indeed generally for opening abscesses from within outwards, is one with a narrow blade accurately grooved and perfectly keen. It is held more or less obliquely, according as the deeper wall of the abscess is more or less distant from the surface; if this were touched, and cut with the point of the instrument, the inconvenience, in ordinary cases, would scarcely merit attention; but the danger would be so great, when the abscess lies before one of the larger arteries or an important viscus, that the mere idea of such an accident is dreadful. It is a precaution, then, of prudence, if not of necessity, at once, as soon as the cessation of resistance or any other circumstance gives notice that the instrument has entered the cavity of the abscess, to turn it into a position more nearly parallel to the axis of the limb or of the diseased part, and to prolong the incision only by raising and withdrawing the bistoury. In practising this mode of incision, the stretching of the parts with the left hand, whilst the right hand operates with the bistoury, although useful is not always necessary. If the collection is large, superficial, or situated at a great distance from any delicate part, you may even dispense with the support of the fingers, and depend solely upon the movements of the hand, as if you were swaying it in the air. After a little practice in the use of the instruments, one of the fingers detached from the others, and placed upon the side of the blade, secures you against the danger of pushing the point of the bistoury to too great a depth, and takes the place, in the greater number of cases, of every other precaution.

§ 2. *Incision from Without Inwards.*

The diffused abscess, the deep abscess, and those which develop themselves around the articulations, upon the passage of vessels, and upon the surface of organs, which it would be dangerous to touch or pierce, usually require that the opening should be made from without inwards. The first require large incisions, either with the straight bistoury in the first or in the third position, or the convex bistoury held in the same manner. With the straight bistoury in the first position, the incision is made by applying the whole length of the edge upon the skin, as for deep scarifications, and it is drawn backwards, and at the same time pressed so as to cut rapidly from heel to point. In the third position the point is at first plunged directly into the sac, and the incision is then continued by bringing down the heel and the rest of the edge, the point remaining stationary. The bistoury becomes thus a lever of the second class, but working from above after the manner of a straw-cutter. With the convex bistoury, held in the first position, you cut quick and deep; it suits generally better than any other such a purpose as this, and is particularly well adapted by its form to cases in which it is necessary to make several incisions at some distance apart, over the surface of a purulent collection. The second class of abscesses divides itself naturally into two orders:—1st. Those which are covered over with a thick and dense layer, and do not lie upon any organ which it is important to avoid. 2dly. Those which lie so deep that their precise seat cannot be ascertained, or which it is not prudent to expose at a single stroke. There is no objection to attacking the first kind by puncture and a depression of the handle, using the straight bistoury held in the third position; for example, on the eminences of the hand, on the palmar surface of the fingers, on the external sides of the limbs, on the breech, on the cranium, and in the posterior region of the trunk.

The incision by puncture is not applicable to the second class of abscesses. If these are to be opened with the straight bistoury, it must be drawn with the edge towards the abscess in the first or third position, and divide, by successive strokes, the parts which conceal the matter, while the fore-finger of the left hand is, from time to time, applied to the bottom of the wound to ascertain the fluctuation or the probable depth of the abscess. This is the proper mode of operating for abscesses formed under aponeuroses, between the crural muscles and the thigh-bone, in the hollow of the ham, about the humerus, in the thickness of the abdominal parietes, or of the muscular covering of the chest, or on the forepart of the neck.

Unless we proceed with the same caution in the neighborhood of the joints, we shall run the risk of opening the subjacent capsules and the synovial membrane, and of exposing bony surfaces to the air, whilst these incisions, made through successive layers, do not prevent you from entering the capsule at last, where this is deemed indispensable. If the abscess is extensive, and its external wall sufficiently extenuated, the convex bistoury is preferable, because it makes a cleaner incision, and gives less pain. When its seat is less clearly indicated, we have recourse to the straight bistoury, which is better adapted to the more delicate operations.

The same principles will guide us in cutting about an artery, an aneurism, or a hernia, near the pleura or the peritoneum; because then the operator is sure that he shall not pass the interior wall of the sac before meeting with the pus, and that he may interrupt the operation when he chooses, to feel the pulsations of arteries, and to ascertain with the finger upon what tissue he is working:

whereas in operation by puncture, there is nothing to guarantee the safety of the concealed organ when once the bistoury has begun its progress. How many times has the instrument been plunged, in opening an abscess, into an aneurism, or a large healthy artery, or a hernia, and that too by celebrated practitioners, simply for want of paying proper attention to these indications!

One of the principal faults to be found with incisions from without inwards is that of pressing upon the abscess in opening it. It is no sooner opened for some few lines, than this pressure forces out the pus, lessens the tension of the partitions, and renders it almost impossible to continue the incision at the same stroke; this, however, should only be understood of slow or gradual incisions. Those which can be made briskly with the whole edge of a straight bistoury, or what is better, of a convex bistoury held in the first or sixth position (as in collections of great extent, situated immediately beneath the skin), have not the same inconvenience, and are in fact the least painful of all.

With a Director.—To enlarge the opening of an abscess, the finger or the grooved director serves as a guide to the instrument, and the bistoury or the scissors are directed in the manner already laid down in speaking generally of incisions from within outwards, with the aid of a director and a previous opening.

§ 3. *Complex Incisions.*

The same rules will govern the operator if, instead of a simple incision, he wishes to open an abscess by an incision in the shape of a V, a T, or a cross. Modifications like these, which are more frequently useful than the greater part of practitioners seem to admit, are of very great advantage in cases of subcutaneous collections with alteration of the skin. The first opening being made upwards, and to the left for instance, the director finds itself a passage under the skin to the right; a second incision is then made in the latter direction, and the abscess, laid open, presents a V incision. When the *cul de sac* is on one side, an incision in T is made, and in collections where it is desirable to lay the bottom entirely open, the crucial incision finds a place. Thus we see that, except elliptical or semicircular incisions, every description of division can be called in in the treatment of purulent collections, but yet that the simple incision is almost uniformly the only one required.

Art. 4.—*Incisions applied to the Dissection of Tumors and of Subcutaneous Cysts.*

In the excision of cysts and tumors, *contrary* to what has just been said of the treatment of abscess, the complex excision is most commonly indicated. When the whole of the skin should be preserved however, a simple incision will often suffice. Vascillating or very movable tumors covered with sound and flexible skin, do not always require a complex incision. The testicle, the breast, and several degenerate ganglia, are often extracted by a simple straight incision, although they may have acquired a very considerable size.

§ 1. *Form of the Incision.*

1st. *The straight incision* should pass from a half-inch to an inch, or even more than that, beyond the limits of the tumor at either end, and penetrate

the entire thickness of the adipose layer. There are then several methods of continuing the operation. One of those most frequently adopted is, to seize with the forceps or the first fingers of the left hand, each of the lips of the wound, and to dissect them, one after the other, from the wound outwards, with the right hand, whilst an assistant draws the tumor in the opposite direction, with his fingers, a crotchet, or a hook. Others prefer, where the parts are sufficiently loose and flexible, to press with the thumb and fingers of one hand through the skin, upon the sides of the body to be extirpated, as deeply as possible, as if to expel it through the wound, whilst with the other hand, the adhesions of the cellular tissue are cut perpendicularly, in proportion as the borders of the incision separate or withdraw themselves backwards. If the tumor is pendulous you attain the same end by grasping it below with the whole palm of the hand. By this method the pain is generally less, the operation at once prompt, easy, and sure, but unfortunately is not in every case applicable. Some find it more convenient to hold the tumor themselves, and to cause the lips of the incision to be drawn back by an assistant, whilst they dissect and detach it from its bed. Indeed this is the best way to operate in almost every case as soon as its anterior face has been exposed. In adopting any other course for the purpose of separating it from the deeper tissues, the surgeon exposes himself to the danger of penetrating too far, or else of not removing all the diseased parts. He can in this point of view rely only upon the testimony of the fingers, which have however the inestimable advantage of being able to feel arterial pulsations if they present themselves, and to confine their movements without difficulty as well as to adapt them to the action of the other hand.

2d. V *Incision.*—It is an erroneous idea that the elliptical and crescentic incisions are the only ones which permit the actual abstraction of substance from the integument. The V incision has more than once fulfilled the same indication. By cutting several Vs or triangular flaps, continuous at their bases upon the surface of voluminous tumors, there may be raised with the diseased mass a star of integuments, which does not afterwards hinder the covering of all the bloody surface with the remaining triangular portions. M. Delpech and M. Clot, have had recourse to a similar device in the extirpation of *elephantiastic* tumors, of which they have given the first notices, and I have seen M. Roux operate in this way for the removal of a fungous hematodes from before the knee.

3d. *The* T *incision* or a *crucial incision*, is only used where the skin, of which it is not desirable to remove any part, is not flexible enough to allow a straight incision properly to expose the tumor. It is also indicated in certain cases, conjointly with the elliptical or crescentic incision; for example, when the base of a cyst extends so far beyond the flap of integuments which has just been circumscribed that it appears difficult to raise alternately the lips of the wound, or where it is desirable that the flaps should not be very large. In this case all that is to be done is to divide transversely one of the edges of the ellipse or crescent for the T incision, or both of them successively for the cross.

§ 2. *Dissection of the Flaps.*

Whatever may be the then form or extent, these different incisions give rise to flaps which it is necessary to raise from the apex to the base. This is usually the most delicate part of the operation, and is not executed by precisely the same rules for the exposure of all kinds of tumors.

1. *Concrete Tumors.*—Whenever it is necessary to operate for the removal of adipose tumor, or any other solid mass free from malignity, the edge of the bistoury should be more inclined towards the tumor, or the deep parts, than towards the skin, since the thicker the flap is left by raising with it the cellular or adipose mass which lines it internally, the more life it retains and the more it is disposed to attach itself to the layers beneath. If inclined in the opposite direction, the instrument would leave the skin entirely naked, might even pierce it, and render its preservation or restoration impossible, while even, if we should proceed too far inwards, I cannot see what evil could arise from it.

2. *Cancers.*—Carcinomatous tumors deserve a little more attention. The skin should not, indeed, be denuded, but it is necessary at the same time to avoid turning over with it the least trace of the morbid tissue.

3. *Cysts.*—The removal of encysted tumors, of sacs filled with matter wholly or only partially liquid, which it is desirable to remove without opening them, require still more care; the sides of the cyst are sometimes so thin that the least pressure with the edge of the bistoury divides them; the bag is quickly emptied, and the tissues can no longer be held tense; the operation which, without this accident, would have been one of the most easy and simple, becomes immediately most laborious, and even in some instances insusceptible of completion. It is necessary then, although we endeavor to preserve the cellular tissue in exposing a cyst, to turn the edge of the instrument a little more towards the integuments than in the direction of the tumor, whenever the parietes of the cyst are superficial enough, or appear thin enough to be easily pierced.

For the rest it is well to remark, that certain cysts do not require so much caution, and that the operation may be confined to cutting through the whole anterior wall by a simple incision, by a T, or by a crucial incision, as in the case of abscess. To this class belong deep and adherent hydated tumors, or those of which it is desirable either to cauterise the interior of the cavity or to expose it to the air, in order to occasion suppuration. We shall see hereafter that the same may be said of the encysted tumors of the cranium and some others.

4. Abdominal cysts, and collections of liquids which border upon the great cavities of the trunk, and the adherence of which to the serous membrane of the walls of those cavities is not fully ascertained, often justify a mode of incision much boasted of by some practitioners in modern times. It is a simple incision, *straight* or *curved,* carried through, layer after layer, by successive strokes with a straight bistoury held in the first or second position with the edge towards the cavity. If the cyst is in the abdomen, the incision is carried by degrees as far as the peritoneum, which is opened over the tumor if it is found not to be adherent, and which is left untouched if it appears to be incorporated with the parietes of the morbid sac, and these very much extenuated.

The operation here terminates for the time, the seton-cord is placed lengthwise in the wound, so as to keep the lips separate, and is renewed as often as may be necessary for a certain number of days. Constrained by the pressure of the divided tissues, the cyst inclines to slip between the lips of the incision, approaches the exterior, and often finishes by bursting, or by opening spontaneously, sometimes the next day, but more frequently at the expiration of several days.

If it was unattached, this incision would occasion an adhesive inflammation, which would immediately unite the anterior partition to the laminæ which

cover it; puncture or incision could then be practised without the least danger of an effusion into the abdomen.

Art. 5.—To cause the least possible Pain.

To avoid giving pain in making incisions, is a chimera which is not at this time pursued by any one. Cutting and pain, in operative surgery, are two words which always suggest each other in the mind of the invalid, and the association of which it is always necessary and proper to recognize. The efforts of the surgeon should then be confined to rendering the pain of the incision as light as possible, without endangering in any degree the success of his operations.

The pretensions of several foreign writers, German surgeons among others, and of the editors of the work of Sabatier, who think that they have attained this end by never using the bistoury without having first dipped it in oil, seem to me entirely without foundation. By attaching itself to the pores of the bleeding surface, the oil would even have the ill effect of impeding the circulation of the fluids, the exudation of the plastic lymph, and the cohesion of the sides of the wound, if it is intended to effect this by primary inosculation; a cerate which could be removed by washing would be more suitable if any fatty substance whatever could be of use. It cannot be denied, that after being held for a moment in warm water, as is advised by M. Richerand, or in any other way kept at the temperature of the body, according to the opinions of M. J. Guyot, the operation of the instrument can be supported with less pain to the patient, but upon a close examination the difference is not very strongly marked; the precaution would cause too much embarrassment for it to be adopted in practice, or to be accorded any great degree of importance. It is first to the hand of the operator, and next to the qualities of the bistoury, and not to such accessory circumstances, that we are to look for the remedy desired.

Have a light and sure hand, a bistoury with a fine and keen edge, give your incision at the first stroke all the length and depth which it ought to have, if you can do so without danger; act promptly and without hesitation; give to the wound an extent rather too great than too small, yet without unnecessarily prolonging it, and you will have to regret or to apprehend no other pain than that which is inherent in the operation, and which no human contrivance can detach from it. Any further details on this subject would be entirely superfluous.

SECTION III.

Punctures.

Whenever the surgeon thrusts the point of the instrument through any of the tissues, he makes *a puncture*. Those from within outwards are almost always made with the bistoury, the suture needle, or with spring instruments. Those which pass inwards from without are made sometimes with the straight bistoury or the lancet, as we have seen above, sometimes with the needle or other particular instrument, a trocar, &c.: *with a round straight needle*, in certain sutures, provided with an eye at the blunt end similar to ordinary sewing needles: with a needle longer than the other, and provided with a *head*, a *handle*, or a *ring*, such as that used for acupuncture: with a needle cutting at *the point* on one or both sides, straight or curved, for the purpose of exploring certain tumors, or collections of a doubtful character, as has been recommended by many practitioners after Dr. Hey: with a needle curved

in the *arc of a circle*, edged, and provided with an eye to carry the thread used in most kinds of suture: with the different kinds of trocar, when a canula is to be introduced into the bosom of some reservoir or cyst, in order to extract the fluid, without leaving any considerable wound to cicatrize.

1. By *acupuncture* is understood a puncture which traverses the tissues without breaking the continuity of their fibres. The needle which is used for this operation should be a regular cone. The surgeon pushes it in, rolling it at the same time between the fingers of one hand, which hold it like a pen and press it gently upon the skin, which is stretched by the other hand: thus conducted, its point removes from its track, but does not divide the organic fibres; can traverse the arteries, the heart itself, the most essential organs, without occasioning the effusion of any liquid, and without leaving the least trace of its passage. In China and in Egypt where acupuncturation has been known and practised from time immemorial, and with great success, they frequently strike with a little mallet on the extremity of the needle as it is held in the left hand, to cause it to enter, instead of rolling it between the fingers of the right hand. Entering it more rapidly by a simple effort of pressure, as is practised by some persons amongst us, generally causes somewhat more pain than is necessary, and prudence will not allow us, on the principles here laid down, to pass it through any great vascular canal.

2. The needle assigned to *ordinary punctures* is more easy to conduct, and should not be so slender. Although the round needle has been recommended for opening a gaseous collection in a strangulated portion of intestine, the needle, shaped like the head of a lance, with the point straight or curved, is almost always used for the purpose of exploring. A tumor presents itself in a complex region of the body; you are not certain that it contains a liquid, or if it does, whether this liquid is of blood, pus, or serum; whether it is an abscess, a cyst or aneurism. The puncture with an appropriate needle at once dissipates these doubts. If there is any fluid at the bottom of the mass, it allows some drops to ooze out and affords an opportunity to determine its nature. The small wound which is produced is immediately closed, even in the case of arterial cyst. The surgeon then takes his course with a full knowledge of the case.

3. The use of the trocar is distinguished principally from that of the needle, by the canula which the instrument carries with it, and which becomes the conducting tube for the fluids which are intended to escape. Its point should be flattened like that of a lancet, or pyramidal with three cutting edges, and as it is generally blunt it requires some force to make it penetrate; hence the necessity of grasping the trocar with the whole hand. The handle is placed between the *thenar* and *hypothenar* eminences, or between the hollow of the palm and the last two fingers flexed. The thumb and the middle finger a little farther advanced, hold it near the root, whilst the forefinger extended sustains the body of the instrument near the point, in order to limit the depth to which it should penetrate. In case of necessity, we might for greater safety detach the middle finger from the instrument, and rest it on the side of the point to be pierced. When it is entered, the forefinger and thumb of the left hand hold the canula with the point of the cup downwards, whilst the right hand pulls by the handle and raises the perforating shaft. The sac is emptied, and the liquid contents received in a vessel. In order to withdraw the tube it is only necessary to draw it quickly by the head, whilst the fingers which, until then had sustained it, are applied to the sides of the puncture, so as to retain in its position the skin or the outer wall of the cavity.

CHAPTER II.

REUNION.

The reunion of the divided parts is effected by the position of the patient or of the wound, and by means of bandages, of plasters, and particularly of suture.

Art. 1.—*Suture.*

The bringing together the lips of a wound with the assistance of threads or of metallic wires, is the only one amongst the various means used in effecting reunion which deserves the title of a bloody operation, and the only one which it is necessary at present to examine. The suture, which is evidently borrowed from the art of the tailor, formerly enjoyed more favor than can be easily conceived at the present day, from an examination of the practice of the greater number of operators. Since the time of *Pibrac*, who so heartily condemned the practice, and who, in a memoir, at best by no means conclusive, endeavored almost entirely to banish it from the domain of surgery, the suture has continually lost ground in the estimation of practitioners; so that now it is no longer actually recommended in classical works, except in a very limited number of cases. On both sides, as usual, the bounds of truth have been transgressed. If the suture does not merit the praises formerly lavished upon it, as little does it deserve the neglect into which it has lately fallen. The only well-founded reproaches which can be advanced against it, are, that it prevents the due escape of fluids, increases the pain and the inflammation, and prolongs the operation. But the first of these objections lies against the immediate reunion, rather than against the suture; and it needs only to have witnessed what occurs in cases of *hare-lip*, *staphyloraphy*, *rhynoplasm*, *genoplasm*, *cheiloplasm*, and *enteroraphy*, to be convinced that the second and third objections have been at least much exaggerated. In these kinds of reunion, it is not the pain nor the inflammation which occasion failure; and the operator would be fortunate indeed, if, in a like case, he had to contend with no other difficulties than these. As to the greater duration of the operation, who will venture to lay great stress upon this, if the suture really possess the advantages accorded to it before the time of Pibrac and Louis? In justice it must be said, that it is not actually dangerous, as has been contended by the old academy of surgery, but yet that it is most frequently useless, and at most but seldom indispensable. It can only be indicated in wounds where the immediate reunion of the parts is desired; and even in this kind of lesion there are many cases in which it might be omitted without injury. While we count it better than any kind of bandage or plaster that can be contrived, where it is necessary to bring into apposition the edges of large flaps of integuments, movable or ill-supported, or of membranous or very thin organs, it would be but a feeble resource in wounds of which the lips are firm and loaded with cellular tissue, which penetrate to the great muscles of the limbs, or of the trunk, and of which the sides are perpetually swayed by the movements of the parts beneath.

When the suture is used, no pressure is required; the wound can be gently dressed without any dragging of the surrounding skin; and the apposition, which incurs no risk of being deranged, extends through the whole thickness of the bleeding edges. In the use of strips or bandages, the skin is more or less irritated; the contact is rarely perfect, and if the skin be in the least degree soft or loose, the lips of the wound continually tend to roll inwards, and only touch by the part of their thickness next the epidermis. The least effort, the least imprudence, causes a separation. Besides, this mode of effecting a reunion is not applicable to every region of the body; we do not see that it is much more difficult to relax or to cut a stitch than an emplastic strap or a piece of linen, if strangulation should occur.

Without reposing in this method as much confidence as is conceded to it by Delpech, Gensoul, and most of the surgeons of Marseilles, Brest, and Toulon, and the principal cities of the south, an abstract of whose views has been given by M. Serre, of Montpeliers, in his treatise on "immediate union," I am inclined to coincide with him, as also with MM. Dupuytren, Roux, and Lisfranc, in the opinion that it is worthy of resuming a more prominent place in the practice of surgery.

Of all the kinds of suture which have been devised, the science has only preserved, and in fact, only should preserve the interrupted suture (by separate stitches), the "seamed," or that of the glover, the "zig-zag suture," the suture of Le Dran, the "twisted," and the "quilled" suture.

§ 1. *Interrupted Suture.*

To effect a suture by separate stitches, it is necessary to provide as many pieces of thread, single, double, triple, or quadruple, as you may intend to make stitches; taking care that they are well waxed; next, a sufficient number of needles. The needles which were used in the last century, curved and flattened only in the anterior half of their length, straight, round, or slightly depressed laterally, and pierced in the same direction, with an extended eye, are now entirely abandoned. The needles universally preferred, are regularly curved in the arc of a circle; of equal width and thickness from one end to the other, except within a few lines of the point; provided with a square opening in the posterior extremity made in the direction of the thickness.

It is only necessary to place a needle at each extremity of the thread, when the stitch is to be made by piercing first one and then the other of the lips of the wound from its internal or cellular side towards the surface, otherwise one needle suffices for each ligature. All other things being equal, it is best to pierce one of the edges of the wound from without inwards, and the other from within outwards; the operation is more prompt and less painful, draws skin less from the exterior to the interior than in the other direction, and does not involve the embarrassment of changing the needle nor the hand, in passing from one edge of the wound to the other. The right or upper lip of the wound is that with which it is most convenient to begin. The surgeon pinches it with the thumb of the left hand on the internal face, and the fore-finger prone upon the external face, raising it and turning it a little outwards, he seizes the needle already threaded with the right hand, holding it like a pen, the thumb in the concavity, the fore and middle finger, sometimes, if the needle be large, even the ring finger, upon its convex part, so as to turn it into a lever of the third class, applies the point to the skin at three or four lines distance from the edge, pushes it by a circular movement so as to make it come out by the wound where the thumb indicates its direction and passage, leaves the heel as soon as it is sufficiently advanced, seizes the point with the

thumb on its convexity, continues its progress, and brings it out by turning the hand towards a supine posture. Taking it then, as at first, he proceeds immediately to the second step of the operation, which is the same with the first, except that the needle ought to pierce the second lip of the wound by commencing on its inner surface, and that the thumb should be used instead of the fore-finger to support the skin. The remaining stitches are only repetitions of the first; and, when several are to be made, the operation is usually begun at the right or inferior extremity.

If any reason exist for following the old method of placing a needle at each end of the ligature, the right or upper border of the wound, held as above directed, should be first pierced from its adherent surface outwards, the hand being at first supine with the thumb on the concave side of the needle, which is pushed in with a movement towards pronation. The perforation of the other edge is made with the second needle just as in the former method.

To close the operation then, the surgeon dries the part or causes it to be dried, seizes successively each ligature by its two extremities, adjusts the co-aptation of the parts, and ties the threads one after the other at the lower side of the wound. The practice of laying lint between the knot and the wound so that the ligature shall not lie immediately upon the skin, although it has been recommended by many persons, can only be justified in cases where it is necessary to relax the suture within one or two days after its application. In every other case the ligature should rest upon the skin, without any thing to intervene. A pledget of lint, or charpie, spread with simple cerate, then some dry lint, and one or two turns of a roller applied over all, will serve to support them, where it is not thought sufficient to cover the parts with simple *compresses* saturated with cold water, or even to leave them exposed to the open air.

If nothing particular occurs, the thread is not to be withdrawn until about the third, fourth, or perhaps the fifth day, in order to which the lower extremity of the exposed part of the ligature is cut with the scissors. The surgeon then takes hold of the knot or superior extremity with the right hand, and removes the ligatures gently one after the other, whilst with the fingers of the left hand he keeps in place the skin and the corresponding lip of the wound.

§ 2. *Suture of Le Dran.*

Le Dran conceived the idea that, especially in enteroraphy, after having passed the threads with a straight needle, as in the interrupted suture, it would be advantageous to unite the extremities of all the ligatures in a single cord, and to retain them, thus collected, upon the exterior without a knot. His object was, to be enabled to leave them in longer, and to withdraw them separately without the necessity of cutting any thing. The fault of the process of Le Dran is, that a wrinkling or plaiting of the membranes is produced by drawing the ligatures together on each side into a single cord. The suggestion, therefore, is not available, except in cases where a single ligature will suffice, or when, if several have been passed, the extremities can be retained on the exterior separately, as is now done in some intestinal sutures.

Continuous Suture (seamed).

The suture, properly called the furrier's, not Pelletier's,* as it has been

* The mistake has arisen from the correspondence of the above eminent name with the French word for glover, or furrier.

written in several modern books, in which the authors have taken, not the name of a port, like the ape in the fable, but that of a trade for the name of a man, is that which is usually employed after the opening of dead bodies, and in veterinary surgery. Although formerly as often used in the practice of human surgery, it is now almost entirely excluded, but, I think, very improperly. Wounds that are somewhat long, or such as involve hollow organs, are as advantageously treated with this suture in the living body as in the dead; and the strangulation, which it is charged with causing so easily, is with so little propriety urged as a motive for rejecting it, that this is, in fact, less frequently followed by that accident than the other kinds of suture.

The seamed suture is so well known in the furrier's and tailor's arts, that its very name is equivalent to a description. It is commenced like the *interrupted suture*, except that a straight needle is more convenient than one which is curved, and that instead of piercing the lips of the wound, one after the other, you endeavor to bring them together, and take them up in the same fold, so as to penetrate them both at the same stroke. An assistant then draws and stretches out the two extremities of this fold; the operator pinches it from above with the thumb and fore-finger of the left hand in a prone position, brings the needle to the right or superior lip at a convenient distance from the fissure, transpierces the fold, withdraws the thread, the extremity of which is held by the assistant, or which he stays with a knot, brings back the needle obliquely across the wound to the same side of the skin, three, four, or five lines from the first puncture, and continues in this way until the last stitch passes a little beyond the other extremity of the fold, so that the entire suture shall present a certain number of spiral turns. If it does not appear to be sufficiently closed, the two ends are drawn before being fastened; in the contrary case, the lips of the wound are somewhat separated. If it is well done, the lips of the wound, without being tight, should touch along their whole extent, and the fold should be wholly effaced. The suture is then definitively finished, by passing each of the extremities of the ligature, like a slip-knot, around the adjacent spiral. When you wish to remove it, each oblique loop is to be cut with the scissors, and then withdrawn singly; or you may merely unfasten the upper end, and then disengage successively the different spiral turns, and draw it out entire by its lower extremity.

When both lips of the opening cannot be included in the same stroke of the needle, each turn of the seamed suture is practised exactly as in the case of suture with separate stitches, from which, in fact, as we have seen, it very slightly differs.

§ 4. *Zig-zag Suture.*

This suture, the idea of which is attributed to Bertrand, is made with a continued thread, the same as the one just described, and is begun and finished in the same way; but instead of crossing spirally in front of the wound, the thread passes through the fold alternately from right to left and from left to right, forming a complete zig-zag, which leaves the anterior aspect of the bleeding surface entirely free and uncovered. In performing this suture the needle traverses the tissue, beginning with the *right* border; being drawn out by the *left* border, it again passes through, but in an opposite direction, a little above, coming out by the right border; it is then returned on this side some lines higher, and being again drawn out on the other, it is carried, as in the first case, somewhat further, so that it proceeds in a serpentine, and not in a spiral course, as in the case of the furrier's suture. Some surgeons

ascribe to it the advantage of not tearing, or cutting the tissue so easily, in consequence of the lateral loops which it forms between every two punctures, and that it does not strangulate the parts like the other, by passing over them. Admitting this to be the case, it must be allowed on the other hand that it has the fault of drawing unequally the two halves of the wound, and of giving no support to the anterior surface. Although slightly improved by *Beclard*, the zig-zag suture is scarcely ever used, and can always, in fact, without danger or inconvenience, give place to the interrupted, or to the seamed suture.

§ 5. *The Twisted Suture.*

One of the sutures most in vogue, is that which is practised by means of threads passed in different ways around metallic pins, which are allowed to remain in the thickness of the flesh. Needles of iron, steel, gold, silver, lead, copper, brass, &c., straight, curved, thick, thin, long, short, round, and flat, have been employed in this operation; but at last this great variety has given way to the almost universal employment of ordinary pins, which are every where at hand, and which are found in actual practice to answer every purpose as well as needles of the most precious metals and most ingeniously contrived. They are prepared by sharpening and flattening the point upon a stone, and covering them with cerate. If the wound is seated in a movable part, such as the lips, or the eye-lids, the pin nearest to the free border of the organ is the first applied, the others are afterwards successively inserted. As this species of suture is to be minutely described in treating of *hare-lip*, it would occasion useless repetition to detail here the particulars of the operation. When the two extremities of the wound are closed, or it is required to connect cutaneous flaps, the placing of the needles is not subject to the same rules. The operator then commences at the centre, the extremities, the point, the sides, or the base of the parts which he wishes to bring in apposition, according to the difficulties which he thinks he has to surmount. In this respect he must rely upon his own particular intelligence. The right lip of the wound being seized with the fingers of the left hand, as in the case of the interrupted suture, or with the forceps, the hook, or any other operative means, according to the case, he plunges the prepared pin from without inwards, and causes it to appear in the interior of the wound, continuing to push against the other lip, which he seizes in turn and pierces from within outwards, so that the needle will come out at the same distance upon the skin. He embraces the needle immediately with a turn of thread which he passes under the head and point, at the same time that it crosses the front of the wound, and tends to press the two sides against each other. An assistant takes the ends of this looped thread and holds them a little extended, while the surgeon proceeds to the application of the other pins.

As soon as they are all placed, the surgeon proceeds to secure them by casting the thread around them. The middle of a long ligature put above the last, is passed and crossed many times around its extremities in the form of a figure 8, then conducted in the form of a X to the next needle, and turned in the same manner around its head and point before it proceeds to the third, from which it is returned to the second and the first by renewed crossings. He then concludes by knotting or twisting the two ends together, and turning them under the body of the needle. To prevent these needles from wounding the integuments, a small strip of plaster or roll of charpie is placed under each of their extremities. Nothing further is required, than some suitable covering if such a thing is deemed requisite.

These are to be removed at the same time as all other sutures. We commence by the needle which supports the parts the least, so as to leave the removal of the others until the next day, if we do not find a reunion sufficiently solid. If there be any fear on this head it is proper only to remove the needles and leave the thread a day or two longer, which, being attached to the parts, and having become more or less consolidated, perform the office of adhesive strips. This fear further requires that the surgeon should carefully support the right lip of the wound with the fingers of the left hand, while with the other he draws out the needle by the head in a straight line, or by giving it small rotatory motions.

The punctures which the needles leave suppurate a day or two, and cicatrize like all other wounds of the same class.

§ 6. *Quilled Suture.*

The practice of infibulation, which is still in use among some of the oriental nations, but which has for many years ceased to be used in Europe, except to prevent the approaches of the male of certain animals to the female at improper times, is a sort of quilled suture; but instead of the metallic rods used in operating upon the mare, this suture is effected upon a human subject with threads and two small rolls of something more solid. The quilled suture is performed in the same manner as the interrupted suture, but with double threads, preserving a loop at one extremity. When they are all placed, a slip of wood, the barrel of a quill, a bougie of elastic gum, or even a rouleau of waxed cloth, or a small metallic rod, in short, any cylindrical body of a convenient length and thickness, is slipped along parallel with the wound into each of the loops. The other extremity is then also undoubled for the purpose of receiving a similar slip of wood or other body, upon which the threads are successively tied, having previously secured an accurate apposition of the edges. Care must be taken not to exercise too forcible a constriction, nor yet to allow any gaping of the sides of the wound.

Although rarely indispensable, the quilled suture has always the advantage of exercising a pressure perfectly equable upon all the points which the thread is intended to bring together, of being more firm than any of the others, of being less apt to lacerate the parts, and of being particularly adapted to straight, long, and deep wounds of the walls of the abdomen and of the limbs. The only objection to this suture is, that it requires a little more time and care than the continued suture.

In using any species of suture, we must avoid needlessly multiplying the stitches or leaving them too far apart. The intervals must vary according as the strain to be opposed is more or less considerable—the incision more or less extended—the parietes to be repaired more or less flaccid—more or less difficult to be kept in apposition. A stitch for every half inch is generally sufficient; while there are cases which require one in every three lines, and others in which the stitches may be an inch apart. What has been here said however, cannot be fully understood without the aid of particular examples, which would here be out of place.

COMPLEX OPERATIONS.

OPERATIONS UPON THE BLOOD-VESSELS.

CHAPTER I.

OPERATION FOR ANEURISM.

The true aneurism or a dilatation of all the arterial coats ("the circumscribed arteriectasis"), so long admitted as the most common, but the existence of which has been contested by *Scarpa* and *Delpech*, although really very rare, has yet been sometimes observed. Hodgson cites several examples: M. Floret declares that he has seen a number situated at intervals on the first four intercostal arteries, and M. Berard, sen., has deposited in the museum of the faculty a preparation, which leaves no doubt upon the subject. It will be perceived in the preparation, that on its passage between the pillars of the diaphragm the aorta presents a fusiform swelling as large as the fist, in which three arterial coats are still distinguishable; the root of the cœliac trunk, which corresponds with the middle of the tumor, is itself much dilated and spread out like a funnel, and the same appearance is presented by the superior mesenteric.

Another species of true aneurism can now be established, which also sometimes claims the assistance of *Operative Surgery*. It is the *diffused Arteriectasis*, which only affects the arteries of the fourth or fifth order, which are then thickened, dilated, and contorted, as if affected with hypertrophy, and somewhat similar to varicose veins. It, however, occupied the femoral as well as all the other arteries of the leg, in a case which was treated last year by M. Dupuytren, at the Hotel Dieu. Park has seen the posterior tibial artery in this state, and Pelletan the occipital, temporal, and frontal, in the same subject. All the arteries of the hand and of the fore-arm are sometimes thus affected, as I once had an opportunity of observing at the lectures of Beclard.

Perhaps it would be well to give the name of *true aneurism* of the capillary system to those *erectile tumors* which have already received so many appellations, and which appear to have been encountered even in the thickness of the bones.

False Aneurism, which is characterized by a rupture of some of the coats, or of the whole thickness of the arteries, ought, in theory at least, to bear another denomination, but practical utility rules, and this custom, though by all acknowledged to be vicious, is yet by all observed.

The primitive or diffused false Aneurism arises from the opening of an artery, and consists of an effusion of blood, more or less considerable, in the neighborhood of the lesion, and in that particular differs essentially from all other kinds of aneurism.

In the *circumscribed false Aneurism* some foreign body has perforated the artery, but the blood, escaping by degrees through this opening, forms for itself a sac at the expense of the surrounding cellular substance, and of the external coat of the wounded vessel.

If the blood pass directly from an artery into a vein, by an opening in the adjacent coats of these two vessels, an aneurismal varix is the result.

If a sac is formed in which blood may accumulate between the opening in the artery and that in the vein, there is a *false circumscribed aneurism* complicated with an aneurismal varix, or as some would style it a varicose aneurism.

Mixed Aneurism, or that which is formed by the spontaneous solution of the continuity of a part of the coats of an artery, and by the mechanical dilatation of those which are sound, presents itself, according to authors, under two forms. Sometimes the internal coat distends itself and bulges out so as to form a cyst through an opening in the other two, and which constitutes *internal mixed aneurism*, or *aneurismal hernia;* at other times, on the contrary, it is the external or cellular coat alone which dilates and receives the blood through a perforation of the internal and middle coats: this is an external mixed *aneurism*, or mixed aneurism, properly so called.

But there is no proof that the first of these two varieties is really possible, or that it has ever been positively observed: the fact which is attributed in all the books to Messrs. Dubois and Dupuytren, and which is brought forward in demonstration of its existence, is not conclusive. The experiments of M. Casamayor on dogs, and the new observation which M. Dupuytren has just communicated, do not appear to be much more so. Those of Haller, who has seen, in operating upon frogs, the internal coat of the mesenteric artery form a hernia through the lesser and external coats, can have no weight here, as it will be more easy to explain, together with all that relates to aneurism, after having briefly sketched the surgical anatomy of the arterial system.

SECTION I.

Anatomical Remarks.

Every artery of any considerable size is composed of three coats, three concentric cylinders, very distinct in the great trunks, but which mix insensibly with each other as the vessel diminishes and can no longer be separated when it approaches its capillary extremity.

1st. *The Middle Coat*, also designated as the muscular coat, the yellow coat, the tunica albuginea, is composed of incomplete fibrous circles, and not of longitudinal fibres, united to one another by lamellæ and filaments of the same nature; no vessels, either lymphatic or carrying red blood, are to be traced in it, although certain observers have pretended the contrary; it is almost inert, and breaks like glass; if it is tightly encircled with a thread it tears, instead of being distended when it is subjected to a pressure superior to its natural power of resistance. Although it is elastic like the yellow tissue of the trachea and the ligaments of the vertebræ, which it to a certain

point resembles, it is almost impossible to draw this coat in a direction parallel to its axis without breaking it. By its outer surface it is united to the external coat, through the intervention of an irregular layer of laminar tissue, imperfectly organized; on the inside, the internal membrane is connected with it by a similar medium. As this tunic is devoid of sensibility, and of almost all the properties of animated matter, it is not astonishing that the diseases of which it is the subject should be in great measure independent of the vital phenomena, and should seem to develop themselves under the influence of the laws which govern inanimate matter. It is this coat which distinguishes the arteries from the veins, keeps them patulous after they have been cut across, determines their form and color, renders inflammation of these vessels so difficult and rare, prevents wounds or incomplete divisions of them from cicatrizing by agglutination, and enables them better to resist the lateral pressure of the blood. As the arterial trunk approaches the heart and is enlarged, or when it is destined to sustain a greater pressure, the middle coat is increased in thickness, and that rather more on the convex side of the curve than on the other. When it has reached the branches of the fourth or fifth order, and is approaching the final ramifications of the arterial system, it is observed gradually to become thinner and less distinct, until, at last, it is confounded in a common tissue with the other coats of the vessel. From this it follows that, all other things equal, the arteries are more flexible, more extensible, and less easy to rupture, in proportion as they are smaller and farther removed from the centre of the vascular system.

2d. *The Internal Tunic*, which has been compared by some to a mucous, and by others to a serous membrane, is smooth and generally unctuous on its free surface: on the other it adheres to the preceding coat only by a thin layer of laminar tissue, in which there exist no vessels, nor indeed any other elementary organ. This coat contains no fibres or vascular canals of any description, and is in fact nothing more than a *lamella* of a homogenous substance something like the cornea, the substance of the nails and the corneous tissue in general, facilitating the passage of the blood through all the ramifications of the arterial tree. In the small and capillary branches, this layer is no longer separated from the cellular tunic by the middle membrane, but approaches more nearly the character of a really organized substance, admitting the fluids on its external surface by direct circulation; besides, it is thicker and more distinct, but extremely fragile. It is separated from all the rest of the vascular system by the yellow tunic, and is an almost inorganic layer like the cartilages, endued with very little elasticity, and very easily destroyed. From these characters, it results that the inner membrane of the arteries cannot be primarily inflamed; that it can only become the seat of this pathological phenomenon by transmission from the surrounding tissues; in short, that it is subject only to mechanical derangements, unless it receive, by contact from the other tunics, the diseases with which they may be affected.

3d. *The External or Cellular Tunic* is the only one which presents all the elements of an actual tissue; it is formed of small fibres and lamellæ variously interlaced, like all the other cellular sheaths; fine arterial and venous branches, run through it in every direction. These vessels, known by the appellation of "*vasa vasorum*," supply the entire thickness of the artery, yet do not penetrate into the middle tunic, nor, of course, into the internal; so that the cellular membrane is the only one in which there is a real circulation, and the others, either are not nourished at all, or only keep themselves in their natural state by imbibition, or by simple deposit of molecules. This

texture of the external tunic of the arteries allows it great extensibility, permits it to yield without rupture to all impressions made upon it, to inflame, to cicatrize, to contract adhesions with the tissues about, and to transmit to the other coats its peculiar diseases; whence it follows, that in the capillary system, where it forms nearly all the thickness of the vascular walls, life is more active, and diseases infinitely more frequent.

4. Besides the cellular coat, the arteries are again covered throughout by a sheath of similar structure, but much less firm; this sheath, which is denominated the "*common sheath*," analogous to that which envelopes all the cords, and all the fascicles or assemblages of fibres in the system, increases and preserves the inflexibility of the former, connects it to the neighboring tissues, and principally to the collateral veins.

5. Further, the arteries are every where connected with parts more or less solid and fixed. In the breast and the abdomen the aorta receives no solid support, except from the vertebral column against which it is applied, so that the aneurisms which occur in it, even if they originate on its posterior side, generally project in a lateral direction, or even in front. The branches which it gives in the visceral cavities resting upon no solid bed, would seem from this circumstance more subject than any others to dilatation or to rupture. But the support which they receive from the pressure of the viscera, the great freedom of motion which they enjoy, and the slightness of the impulse made upon them by external agents, explain their great exemption from these affections. In the limbs, where they are surrounded by muscles, and supported and protected by bones, the arteries appear at the first view to have less to fear from the causes of aneurism; but since they are there obliged to follow all the great movements of the frame without possessing the same freedom of motion, as in the abdomen for example, and since the elongations and stretchings of every kind to which they are there subjected expose them to frequent rupture, we have no difficulty in conceiving how they should become on the contrary so frequently diseased—how the ham, the groin, the bend of the elbow, and the armpit, should present so many instances of spontaneous aneurism, while they so rarely occur in the leg, the thigh, the arm or the fore-arm.

6. The arteries receive their nerves only from the plexus of the great sympathetic, and these, like the vessels, are never traced except in the cellular tunic. On the outside however, they are generally accompanied by nerves of the cerebro-spinal system. While we are on this subject, it may be well to mention the law imagined by M. Foulhoux: that with arteries of any considerable size in the superior division of the body, the collateral nerve is always placed on the outside, that is, on the side most remote from the axis of the part, while on the inferior limbs the reverse generally obtains.

SECTION II.

Spontaneous Cure.

Aneurism is always a dangerous disease. Left to itself, it seldom stops short of the destruction of its subject. The parieties of the cyst become more thin as it expands, or gangrene by degrees; the blood and clots contained in the tumor escape, and a profuse hemorrhage ensues, which ceases only with life. It is yet true, that with some persons such a termination may be a long time deferred; that patients have carried for many years, even

for twenty years, as in one case reported by *Saviard*, one, or even several aneurisms, without being seriously incommoded.

But it must not be understood that nature never succeeds in overcoming aneurism; on the contrary, authors relate a considerable number of spontaneous cures of this disease.

M. A. Severin has seen gangrene attack the whole of an inguinal aneurism, and the patient recover. Lancissi cites an observation of an aneurism of the thigh, which, after having acquired a considerable volume, gradually diminished, and at last entirely disappeared. Reinig published, in 1741, an observation of a traumatic aneurism of the femoral, which healed without operation or gangrene. Guattani, Paoli, Moinichen, Clarck, and Albert, each report an example of aneurism terminating in gangrene, and spontaneously cured. In the dead body of a young woman, Mr. Freer, of Birmingham, discovered a tumor about the size of a small apple, entirely filled with solid layers, and which had formerly communicated with the interior of the aorta. Mr. Marjolin speaks of an aneurism of the femoral artery, which resulted in a large abscess, and afterwards healed. But observations of this kind are so familiar at the present day, that it will suffice to refer to them when treating upon each particular artery.

In order to attain this happy result, nature employs different processes. 1st. The entire aneurismal bag may be attacked with gangrene; the fluid which it contains is decomposed, the blood coagulates above and below the perforation in the artery, and sometimes becomes solid enough to completely interrupt the circulation in this point, and to permit the tumor to open and empty itself without danger. The wound which results is cleansed, suppuration is established, and a cicatrix is formed without the occurrence of the slightest hemorrhage.

2. Chronic inflammation may affect the partitions of the cyst, and the surrounding laminæ may extend itself to the arterial trunk, form an actual abscess, occasion an effusion of coagulable lymph above and below the point of the artery which communicates with the aneurism, and produce there adhesions sufficiently firm to resist the impulse of the blood, so that the purulent collection will be enabled to open and to discharge itself without involving greater danger than any other abscess.

3. The tumor, when it is supported by muscles, by aponeurotic expansions, or by dense laminæ of cellular tissue, is sometimes filled up with successive and concentric layers of fibrin, and acquires sufficient size and firmness to react by its superior part against the arterial trunk from which it arose, so as to obliterate it, if it bears it against any solid point, and thus to suspend the circulation through this part of the artery. Then all the blood contained in the aneurismal cyst, coagulates; its more fluid part is absorbed; the molecular action diminishes by degrees the mass of the more solid elements, and the cure of the aneurism is effected.

4th. In other cases of much less frequent occurrence, the different concrete layers which successively line the interior of the cyst at last entirely fill it up, and even form in the opening in the side of the artery, and acquire such a consistence that the blood cannot displace them. They then increase in thickness, approaching by degrees the axis of the vessel, until at last they close it entirely, and thus put an end to the circulation through that part.

5th. Finally, in the other cases still more rare, these concretions, after having completely filled the sac, dispose themselves in such a manner as to close exactly the lateral opening of the artery, which preserves its calibre without preventing the resolution of the aneurism. It was so in the case

spoken of by Mr. Freer. Sir A. Cooper has met with a disposition still more remarkable. The femoral artery, says he, had been the seat of a true aneurism, the interior of which, lined with very firm fibrinous layers, preserved in its centre a cylindrical canal having the same dimensions as the remainder of the artery. This is however, a disposition which appears to have been observed by Guattani, and of which Roe, surgeon in the navy, also thinks he had seen an instance on the iliac artery; but is it certain that a true aneurism existed there?

While aneurism was thought to be most commonly formed by the simultaneous dilatation of all the tunics of the artery, a hope had been indulged of curing it by maintaining the calibre of the vessel in its natural state. It was thought that by skillful management the aneurismal sac might be forced to contract upon itself to resume by degrees the place which it had occupied before, and to restore to the artery its primitive calibre, and all the attributes of the normal state. Scarpa has endeavored, on the contrary, to establish it as an axiom, that the radical cure of aneurism cannot take place, whatever may be its situation, unless the corroded, lacerated, or wounded artery, be to a certain extent above and below the place of its morbid change converted into a solid and ligamentous substance, whether this process be effected by nature or by art. Although such a proposition may be generally true, it is yet liable to some exceptions, even if there were only the observations of Messrs. Cooper and Freer, which have just been quoted, and some others which may be found in the works of M. Hodgson, to oppose its universal acceptation. Scarpa himself relates a fact which contradicts his own assertion. A patient attended by Monteggia, died twenty months after having had the humeral artery pierced by the point of a lancet. The aneurism had been for a long time healed; the artery had preserved its calibre, while in the interior of this vessel a cicatrix was discovered, supported on the outside by a small clot, blackish and very hard, corresponding to the original wound. Observations more or less analogous have been recorded by Saviard, Petit, Foubert, and others. Yet it would be very wrong to count upon a termination like this; it is too rare to permit us to endeavor of choice to obtain it. It is but an exception which does not impair the correctness of the principle of Scarpa.

SECTION III.

Curative Methods.

The aim of surgery, in the treatment of aneurism, should be to effect the most surely, the most promptly, and with the least pain possible, the obliteration of the affected artery.

In order to attain this end, different methods have been tried.

1st. Internal means, and regimen.
2d. Topical applications.
3d. Mediate compression.
4th. Cautery; absorbents and immediate compression.
5th. The ligature, suture, fraying, acupuncture, and torsion.

Art. 1.—*Method of Valsalva.*

Valsalva and Albertini, while yet students of medicine, resolved to treat the first subject that they might encounter afflicted with aneurism, by bleeding

and a weakening regimen. This is their manner of proceeding. The patient, after being bled once or twice, is confined to his bed for forty days, and allowed during that time barely sufficient aliment for the support of life. His allowance of nourishment is to be gradually increased, after the weakness induced by this treatment has almost disabled him from raising his arms or turning himself in bed. Hippocrates had before said, that in case of hemorrhage of the lungs the best method of treatment is to bleed the patient freely and frequently, until he is almost drained of blood, and to reduce him by diet to a state of extreme leanness. Lancisi, Guattani, Corvisart, Pelletan, Hodgson, Sabatier, Boyer, Yatmann and others, have obtained from this treatment, some advantageous results, and have even effected cures, if the annals of Hecker, for 1828, are to be believed. Yet it must be confessed that there is a difficulty in believing in its efficacy. There is no doubt that, by repeated and frequent bleedings and a low diet, the impulsive force of the heart and the throbbings of the aneurismal tumor may be reduced, and the volume of this tumor may be, in the greater number of cases, diminished; but is it not to be feared, that in weakening the patient, we may increase the fluidity of the blood, and that, so far from favoring the concretion and solidification of the aneurism, and the obliteration of the artery, we may render these results more difficult to obtain. When it is recollected with what facility the least emotion, the slightest movement produces tumultuous palpitations of the heart, and that, by thus reducing the patient to anemia we render him incapable of supporting the most trifling operation, and that the slightest indispositon may then be fatal; when it is further remarked, that up to the present time the cures obtained through the method of Valsalva are but very limited in number, if those alone are counted which belong to it exclusively, may we not be permitted to contest its importance? The opinion which I have here advanced, is also very much in accordance with that of M. Dupuytren, and may be found in several theses defended before the faculty of Paris within a few years past.

Nevertheless, blood-letting and an enfeebling regimen should not be rejected in the cure of aneurism. When the disease is seated in the aorta beyond the reach of operation, it is then prudent to have recourse to them, and to join with them the preparations of digitalis, so much extolled by Yatmann, Brooke, and other English surgeons. Some facts reported by Pelletan, Sabatier, Roux, and others, induce us to believe that this compound treatment is not entirely without efficacy, and should not be rejected when nothing better can be attempted. The reduction of the force and frequency of the circulation, which is usually effected by the preparations of digitalis, together with a sensible but moderate diminution of the volume of the blood, will, it is to be hoped, permit the fluid contents of the aneurism to coagulate and the whole tumor to become hard, particularly if the orifice by which it communicates with the artery be irregular and small. We may conceive also how such a tumor, resting upon an artery, might cause its obliteration; because the pressure which it exerts, although insufficient in the natural state, had then become strong enough to resist the diminished impulse of the heart.

Art. 2.—Refrigerants and Styptics.

Almost all the older authors profess to have cured aneurisms by the use of compresses steeped in astringent liquids, or formed of astringent substances, of various plasters, of little bags filled with tan, of decoctions of bistort, oak, and willow bark, walnut leaves, of camphorated spirits, vinegar, or hot wine. They thought in operating in this manner to force the artery to contract upon

itself. Others employed cold applications. T. Bartholin, for example, is said to have cured an aneurism of the arm by the repeated application of snow. But we are indebted to Mr. Guerin of Bordeaux, for the knowledge of the importance of topical refrigerants in such cases. In 1790, a carman was admitted into the hospital of St. Andre, afflicted with an aneurismal tumor, which finally occupied all the supra-clavicular region, and a part of the neck. Several blood-lettings, a ptisan with the *eau de Rabel,* and the use of compresses steeped in oxycrate, placed over the tumor, succeeded in the space of a few months in effecting a cure. In 1795, M. Treyran treated an enormous aneurism of the femoral artery by the same means and with the same success. M. Guerin, jun. has since reported several similar examples. In 1799, Sabatier put an invalid, affected with aneurism of the ham, upon soup and boillou for his whole nourishment, prescribed an acidulated ptisan, applied ice to the tumor, and cured his patient in the space of four months. Pelletan also had recourse to cold applications, at the same time that he was trying the method of Valsalva. Since then Mr. Hodgson, M. Larry, and others, have reported facts, which tell in favor of the method of Guerin. It is then a means to which we may resort, when the more certain methods we possess are not applicable, or when the patients are not willing to submit to them. It may be employed singly, or combined with that of Valsalva, with the mediate compression, or with the due application of a certain number of moxas, as it appears to have been practised many times by M. Larry with advantage. There is nothing about the action of this remedy but what it is very easy to comprehend. Under the influence of such topical applications, the heat of the part is very much diminished; the circulation there becomes less active, the blood which has been effused loses its fluidity, and has a strong tendency to coagulate; and if the disposition of the parts and the state of the system are favorable to such a termination, the artery is closed and obliterated, and the cure is complete.

ARTICLE III.

Compression.

§ 1. *Mediate Compression.*

Aneurism of the carotid, and of the subclavian, have been cured by *Acrel,* by means of a gradual compression exerted upon the tumor. Those of the ham, the thigh, the groin, the hand, and the elbow, have been treated with success in the same manner, by F. de Hilden, Saviard, Tulpin, Weltin, Dehaen, Leber, Plenk, Petit, Theden, Guattini, and many others, so that it is not possible to doubt the efficacy of this method. But it has been used in a great variety of ways: sometimes the compression is only applied upon the aneurism, at other times upon the aneurism and the other parts of the member at the same time, and again it is applied either above or below the tumor.

1. *On the Tumor, or the affected point.*—Galen is one of the first who made use of compression in the treatment of aneurisms; by means of plasters and pieces of sponge, confined by bandages, he perfectly succeeded in a case where the artery had been opened in the act of blood-letting. From the days of Dionis, it has been a common practice to apply pledgets of chewed paper, of agaric, or of tinder, confined by a piece of money, and over these, other masses of the softer material still larger, so as to form a pyramid, of which the point should correspond to the opening of the artery, and to confine the whole by

means of appropriate bandages. The Abbe Boudelot records, that he was himself cured of a false consecutive aneurism, by carrying for the space of one year a little cushion firmly pressed upon the tumor.

Since that period, and especially in the first half of the last century, the improvement of this species of compression has been an object of much attention. Arnaud, Heister, Ravaton, Leber, and others, have proposed different bandages, with the intention of rendering it more easy and more secure. Each endeavored to modify the compressor of Scultet, or the tourniquet of J. L. Petit, and each imagined that he had found the means of curing aneurisms without an operation. Foubert constructed a steel ring of an oval form, having on one of its longer curves a metallic plate furnished with a cushion, and pierced on the opposite side by a screw bearing upon its extremity a second cushion like the first. This ring, when applied, was intended to press only upon the diseased point and the part of the limb diametrically opposite. This machine, although more ingenious than many others, and far superior to those plates of lead, of silver, or of iron, with or without cushions, or sponges, to be confined upon the aneurisms by the aid of ribbons, straps, or bandages, has yet the serious inconvenience of being easily deranged, of not establishing the compression except upon a diseased part of the artery and that of slight extent, of producing engorgement in the parts below, and of being insupportable except by a small proportion of subjects.

2d. *Compression on the whole extent of the limb.*—The compression of the whole length of the affected part should then be deemed preferable to local compression. Gengha practised it in the following manner:—I apply, says he, to each finger a little strip in the form of an expulsive bandage, then I envelope in the same way the hand and the forearm almost to the wound; I then place on this latter a large compress of fine linen soaked in a mixture of terra sigillata, bol ammoniac, dragons' blood, hematite, white of egg, and plantain; I apply over this a thick plate of lead, some compresses, and three or four turns with a bandage passing above the elbow; then I fix with the same bandage over the passage of the artery, on the internal face of the arm, a wooden cylinder enveloped in linen, after the manner of a splint; I then return my bandage over the wound so as to confine it by several turns, after which I moisten the bandage with some astringent liquid, and put my patient on a very spare and cooling regimen.

This is what is generally called the bandage of *Theden*, who previously applied to the tumor compresses steeped in *eau vulneraire*. In using this method the infiltration of the part is not so much to be apprehended; the pain is less lively, and the compression is more easily to be supported; but, on the other hand, the circulation by the collateral or supplementary arteries is by the same means rendered much more difficult than by the other method; the more so in proportion as it is necessary to compress with greater force.

3d. *Compression below the Tumor.*—According to M. Caillot, who said that he received it from M. Boyer, a military surgeon, M. Vernet, conceived the idea of curing aneurism upon the limbs by a compression applied upon the course of the artery at a point situated below the tumor. He tried this method on a patient affected with *inguinal aneurism*, but the pulsation increased with such force in the cyst, that he was soon forced to relinquish his design. This method has been generally blamed, even by those who have adopted the idea of Brasdor on the subject of ligature; but yet it does not seem worthy of entire rejection. If, for example, it were necessary to treat an aneurism, above which it would be impossible, or at least, highly dangerous to apply compression or ligature; if on the other hand, no important branch were

furnished between the cardiac extremity and the free part of the tumor, it is by no means certain that, by compressing the artery on this latter point, you will not succeed in suspending the circulation in the aneurism, in occasioning the formation of a solid coagulum in its cavity, and, in short, of producing the obliteration of the arterial canal, and a perfect cure of the disease.

Compression above the Tumor.—Finding that the bandage of Theden and that of Guattani, and all other instruments for effecting partial compression tend to impede the circulation in the limb, or else to cause the rupture of the aneurism if it do not yield to their application, surgeons have happily thought to compress the diseased artery at the point where it is most superficially situated, between the tumor and the heart. Mr. Freer has strongly recommended for this purpose the bandage of Sennefio. That practitioner first encompassed the whole extent of the limb with a rolled bandage, moderately tight, and placed a pad some inches above the tumor. A plate was then applied to the opposite surface of the part, which he encircled with the tourniquet so as to compress the artery upon a single point with a few turns of the screw. After some hours, says Mr. Freer, the limb becomes œdematous and swells: at that time the tourniquet may be removed, and a pad with a bandage tolerably tight is all that is further necessary. This bandage, which is a combination of those of Theden and of Foubert, appears to me to afford some probability of success. M. Dubois effected the cure of an aneurism of the thigh, by making use of it as a species of spring, constructed on the principles of the tourniquet of Petit, and acting only on two very circumscribed points of the limb. M. Albert, of Bremen, has derived the same advantage from a bandage, which he denominates the "*inguinal compressor*," which is composed of a little cushion designed to be applied against the pubis, over the passage of the femoral artery, and of two straps which embrace the whole circumference of the pelvis and the root of one of the thighs. M. Verdier has arrived at the same result, by means of a bandage which has some analogy to the herniary bandage of Camper. M. Dupuytren has constructed another, composed of a semicircle of solid steel, which is surmounted at one end by a large, thick, and concave cushion, to be applied to the surface of the limb opposite the artery; on the other extremity is a plate of iron which supports, with the aid of two stanchions and a screw, a rounded pad, which may be brought nearer to the first cushion, or removed farther from it, and which is to be applied over the artery. It appears that with a species of dog-collar, M. Viricel, in the hospitals at Lyons, met with the most decided success by compressing the artery above the tumor. M. Morel, who relates these cases in his thesis, advances the idea that success would be rendered more certain if the compression were exerted at the same time on several points of the limb. Lastly, Mr. Blizard and Sir A. Cooper have described another instrument, not less ingenious than those which have been mentioned. A long piece of steel is first fixed upon the outer face of the knee, and of the great trochanter; from the centre of this piece, another piece advances in a semicircle towards the femoral artery, and carries on its extremity a plate provided with a cushion capable of being moved by a screw, and of compressing the artery to the interruption of the throbbings of the aneurism, without impeding the circulation in the smaller vessels. Compression employed in this manner, may, no doubt, succeed, and ought even to be practised in some cases; such as aneurisms in the neck of the subclavian artery, or of the superior part of the femoral, if any circumstance should occur to prevent the use of the ligature; in other cases it would rarely be found beneficial. The patient spoken of by Sir A. Cooper, was only able to

bear it for a few hours. With one of those under the care of M. Dupuytren it was necessary to apply the bandage successively upon several different parts of the artery, and very shortly to relinquish entirely the employment of this mode of compression. M. Roux relates a similar case; and it required all the fortitude and resignation of the patient mentioned by M. Verdier to prevent him from throwing off the apparatus several days after the experiment had been begun. It may, however, without hesitation be affirmed, that compression will cure a certain number of aneurisms in whatever way it may be applied, although the method of Guattani, or that of Theden, appears preferable to all the others.

To draw from compression all the advantage possible, it is necessary to associate with it a regimen somewhat severe, uninterrupted repose, and the employment of refrigerants or astringents; not forgetting, however, that it has succeeded without these adjuncts, even with patients who have not refrained from the most fatiguing exertions, as we see in the man whose case is recorded by Lassus, who after having applied a bag filled with cinders, and fixed by four long linen bandages upon an aneurism of the thigh, thought that he should facilitate his cure by taking every day a hard walk, and using other active exercise to which he had been unaccustomed, and who yet succeeded, at the end of eight months, in getting rid of his disease. If compression had not been superseded of late years by the ligature; if it did not act at the same time upon the veins, and sometimes also upon the nerves; if it were true that it had at least the effect of preparing the way for the successful use of the ligature, by forcing the collateral arteries to dilate, and that it was never dangerous; it certainly would be wrong to neglect it, or not to have recourse to it in particular cases. But the use of the ligature has now become so easy and simple, that it is really almost impossible to accord to other methods any considerable degree of estimation.

Down to the time of Scarpa compression was recommended with ardor, because it seemed capable of causing the disappearance of the aneurism without obliterating the artery. J. L. Petit ventured to set himself up in the academy of sciences the champion of this hypothesis. According to him, when an artery is laterally opened, if it is compressed the blood diffused among the surrounding tissues coagulates and hardens; a portion of the clot stops in the wound of the artery, and there contracts such adhesions that it is impossible afterwards to dislodge it, although the artery itself preserve its calibre and the other characteristics of its natural state. "When the blood is stopped," says Foubert, "the wound upon which a sufficient compression has been made, closes; the skin, the fat, and the aponeurosis, cicatrize; while the incision of the artery does not reunite immediately, but leaves a round opening in which rests a small clot of blood. The compression, continued long enough to secure the induration of the clot, radically cures the disease; but if the arm is permitted to be moved before the clot has acquired a proper degree of solidity to cement the adhesion of the tissues, it escapes from the opening, the blood insinuates itself around it, and removes it from the place which it has occupied." Examples have been given in support of this theory by Petit, Morand, Foubert, and some others. It has since, however, been established as a general truth, that the cures thus obtained were not radical; that the clot of blood, the cork or nail, as it was called by Petit, which fills up the opening in the artery, never identifies itself with the tissue of the vessel, but that sooner or later it is expelled, and a new aneurism makes its appearance. So in the experience of Saviard, a patient who had apparently been cured of an aneurism in the arm, saw the tumor reappear after a lapse of fifteen years,

in consequence of an effort: it is useless, then, to attempt the cure of aneurism by compression, otherwise than by the obliteration of the artery.

This point established, it only remains to determine which among the methods that have been invented is the most likely to produce the desired effect. Scarpa thinks it absolutely necessary that the two opposite sides of the canal should be placed and maintained in contact for a certain time, and that compression upon the tumor produces this effect with difficulty; consequently, he recommends that the artery should be acted upon above the tumor, excepting however recent traumatic aneurisms. Experience is not in accordance with the opinion of Scarpa. Guattani cured four aneurisms out of fifteen, which he treated by applying the bandage upon the tumor itself. Flajani obtained the same proportion of success under the same circumstances, and every day announces similar cures.

The *aneurismal varix*, first observed by Sennert, and afterwards so well described by Guattani and W. Hunter, is better suited than any other species of aneurism to the compressive bandage, and frequently yields to its application. The two Brambilla, Guattani, and Monteggia, relate each an instance. It is a palliative at least, even if it do not produce a radical cure. An elastic sleeve, even a simple laced stocking, will arrest the progress of the disease, and enable the limb to perform its usual functions without causing the slightest danger to the patient. A lady who had been thus treated by Scarpa, wrote to him at the expiration of fourteen years that she did not experience the least inconvenience in the affected arm, except a slight occasional numbness.

If Cleghorn, instead of directing his patient to change his profession of shoemaker for that of hair dresser, in order that he might hold his arms in elevated position, had employed compression, he most assuredly would have derived results equally advantageous. For the rest, since after the expiration of thirty-five years the patient spoken of by Hunter had not become worse, since in three different cases Pott did not feel obliged to operate, and B. Bell, as well as Bertrandi and many others have made a similar observation, prudence and humanity require, where there is no special counter indication, that before resorting to the ligature we should make trial of simple compression in cases of aneurismal varix.

If it is intended only to confine the parts within their natural limits, the laced stocking, or the simple rolled bandage of Theden will be found sufficient; but if a radical cure is to be attempted, this treatment demands additional precautions, the same in fact as for the other sorts of aneurism, that is to say, that besides the rolled bandage, exactly applied from the free extremity to the root of the member, where it is finished with one or two turns spica-wise round the trunk, it is necessary previously to place upon the tumor, if there be one, pieces of lint, sponge, or graduated compresses, steeped in cold and discutient liquids; to fix a pad upon the passage of the artery between the wound and the heart, and to add above, like Sennefio, a compressor like that of Foubert, or of M. Dupuytren.

Whenever the affected arteries rest upon bones, or other solid parts capable of affording a sufficient counter-resistance, and where they are only removed from the surface of the body by the common integuments, the aponeurosis, or cellular tissue, compression offers every possible advantage, and ought to be frequently employed.

§ 2. *Immediate Compression.*

Surgeons have frequently found themselves unable to tie an artery which they have opened either by accident or design; they have then been obliged, in order to preserve the life of the patient, to fill up the wound and compress the vessel, applying directly to it the substances so much extolled by Trew, Teichmeyer, &c. This sort of compression, which is much less frequently used than mediate compression, is also in fact much less advantageous, and ought to be completely excluded from the practice of the present day. Guattani having occasion to treat a very voluminous aneurism of the groin, caused it to be opened by Maximini, with the intention of applying immediately upon the artery, at the bottom of the sac, and against the pubis, graduated compresses firmly confined by a bandage. Every thing succeeded according to the wish of the surgeon; the dressings were removed at the expiration of thirteen days, and the health of the patient was perfectly re-established.

A patient under the care of Mayer was afflicted with an aneurismal tumor in the groin, as large as the head of an infant. That surgeon, at first believing it to be a hernia, resolved upon exposing it for the purpose of effecting its reduction, and did not discover his error until after he had divided the common integuments and the aponeurosis. A great quantity of bloody matter which had accumulated between the cyst and the adjacent parts was removed. Instead of opening the tumor, the pulsations of which sufficiently indicated its nature, Mayer contented himself with establishing upon it an exact pressure which he afterward renewed with the greatest possible care. The patient recovered.

Desault, in a case nearly similar, embraced the upper portion of the artery with two flat pieces of wood, connected by a piece of thread, in the form of pincers, and was thus enabled to pass the ligature; but this conduct, although pardonable at that time, would be justly censured at the present day. If the aneurism is so much elevated as not to permit the exposure or compression of the femoral artery between the tumor and Poupart's ligament, a ligature is applied to the iliac artery, without exposure to those dangerous consequences which Guattani and Desault escaped only by a sort of miracle. Sabatier himself thought it necessary to use immediate compression for an aneurism in the superior third of the thigh. The patient was a young man of twenty-five. Two tourniquets were applied, the one upon the hollow of the groin, and the other a little below. When the tumor was opened and cleared of the clots of blood, the opening in the artery was seen perfectly round. Sabatier passed under this vessel, above and below the aperture, a needle armed with thread, with the intention of making a ligature should it become necessary. A cushion was placed upon the posterior part of the thigh, opposite to the wound, which was filled with a pyramid formed of pieces of agaric and compresses; lint, well sprinkled with colophony was also disposed round the pyramid in such a manner as to support it, and it was kept in place by compresses and an ordinary bandage. A few trifling hemorrhages occurred, but the patient eventually recovered, and was able to walk at the expiration of two months.

Notwithstanding these happy results, obtained by surgeons of the highest rank, the above mode of treatment ought to be proscribed from sound practice. The only occasion to which its use is applicable is, when after having opened an aneurismal sac it is impossible to discover the artery, a difficulty of which we can scarcely conceive the possibility, and which, besides, could now occasion embarrassment only in cases where the malady approaches too near to the splanchnic cavities.

Another species of immediate compression, originating doubtless from the observation of Desault, consists in pressing the artery, whether previously open or not, with any appropriate instrument, and holding it flat until its sides have become firmly united. Percy recommended for this purpose, in 1792, a leaden plate; and afterwards, in 1810, a steel forceps, terminating in two small plates, and furnished with a longitudinal slit, to enable the operator, by meams of a button, to graduate at will the pressure exerted upon the artery.

In the same year, M. Duret, of Brest, constructed an instrument upon the same principles. According to M. Roux, an instrument very nearly the same as the above, was invented, in 1808 or 1809, by M. Levesque, who described it in his Thesis.

A third compressive instrument, invented by Assaline, of Milan, formed of two silver branches, joined like those of the dressing forceps, with a spring between the handles, resembles very much the invention of M. Duret. Assalini affirms that he has cured several aneurisms of the ham and thigh, by leaving his instrument applied for only three or four days, or even 24 hours. Other forceps and metallic instruments of different kinds, have been since invented to attain the same object, and will receive due attention hereafter.

Art. 4.—Cautery.

Two methods of cauterization have been practised for the cure of aneurism. Some practitioners, indeed, before the discovery of the circulation of the blood, had the temerity to apply caustics more or less powerful to the aneurismal tumors, and to the skin which covered them. Others begun by opening and emptying the cyst, and then cauterized the lacerated part of the artery with a red hot iron, or with concentrated acids, or by introducing into the orifice troches, or plugs of alum, or vitriol. At that time also, and even since, surgeons have in some cases contented themselves with filling up the whole wound with lint or oakum, previously steeped in caustic liquids. Such means might be tolerated at a time when surgery had made but little progress, when the nature of aneurisms was unknown, and when scarcely any one possessed sufficient anatomical knowledge to dare to make use of the bistoury; now, however, it is not permitted to speak of such methods, excepting to proscribe them, and to show at what a distance modern surgery is from the ancient.

It has been recently recommended to thrust a needle into the sac in such a manner that it should pass almost through its cavity, and to attach to the needle a metallic chain or rod, capable of transmitting to it an electric discharge. I am not acquainted with any case that can be adduced in support of this recommendation. I only know that M. Pravaz has attempted something like this by means of cautery, and that it is not unreasonable to suppose, that by means of such a contrivance as this we may in some cases occasion the coagulation of the blood, and possibly even a resolution of the aneurism

Art. 5.—Ligature.

As the obliteration of the artery is indispensable, or nearly indispensable, to the cure of aneurism, so the ligature is the surest and best means of accomplishing that object. This is a truth which is not, nor ever has been, contested. But to apply a ligature upon an artery is a painful and sanguinary operation; it is necessary to divide susceptible tissues with a cutting instrument; hence the frequent attempts to discover other and milder means.

§ 1. *Nature and Form of the Ligature.*

Until of late surgeons had used ligatures composed of threads of linen or hemp. A single thread was preferred for the small arteries, while for the large trunks several threads were put together, and formed into a sort of cord by means of wax. It appears, however, that the ancients made use of silk. Guy de Chauliac says so positively. This was still the custom when Scarpa and Jones subjected to the test of reason and experiment, what had before been practised only by routine.

The first of these authors established the point, that in order to obliterate the cavity of an artery it is necessary to bring its *parieties* into contact without lacerating them, and to occasion adhesive inflammation. In accordance with these views, Scarpa recommended the use of two flat ligatures, composed of six strands of thread; and further, that there should be placed between the ligature and the artery a small roll of cloth, six lines in length and three in thickness; this roll is spoken of by Pare, Platner and Heister, and was used by almost all the Italian surgeons of the last century: also by Funchall and Forster. The last substituted a small wooden cylinder, a quarter of an inch thick and three-quarters of an inch long, which Saviard mentions as being in general use in his time, but which Mr. Cline has since replaced by a bit of cork. By these means the inner and middle tunics of the vessel are neither bruised nor lacerated; their contact is perfect; they unite firmly, even before the separation of the two portions of the artery has been effected by ulceration under the cord.

According to Dr. Jones, the opinion of Scarpa is completely erroneous; it is not by the inflammation of their internal surface that the arteries are closed, but rather by the effusion of coagulable fluid which follows the rupture of their inner coats; consequently, instead of large and flat ligatures, with rolls of linen or cylinders of any description, which more or less oppose this rupture, Jones recommends the selection of such ligatures as shall effect it the most easily and the most completely. Numerous experiments were made by him upon dogs and horses, and all had results conformable to his theory, which speedily assumed the form of a law with the generality of English surgeons. To Mr. Hodgson the justice of the hypothesis of Jones seems so evident, that he cannot comprehend how any practitioners dare still to make use of the large ligatures and the little rolls of Scarpa. And it is not without some degree of bitterness that Mr. Samuel Cooper reproaches the French surgeons for being so slow to adopt the practice recommended by Jones, a practice which has induced several of his countrymen to prefer the finest possible threads; threads of silk, of that gummed silk which dentists and anglers use; in short, threads so fine that when they are cut near the knot, as was done by Mr. Lawrence, there does not remain the 20th, or even the 46th part of a grain in the wound.

Without denying the importance of the labors of Dr. Jones, M. Roux continued and still continues to use flat ligatures, which he generally ties over a small roll of gummed diachylum. In support of this practice may be quoted that of M. Boyer, of Scarpa, and even of the older surgeons; for Saviard speaks of the little roll in his treatise on surgery as a thing already in common use. Mr. Crampton, in Ireland, has never done otherwise, and has had no occasion for regret. He has even combated the doctrines of Jones with such ability as to hinder them from being universally received in the three kingdoms. M. Richreand endeavored to reconcile these conflicting opinions, by remarking that a flat ligature becomes round in tying, and that

its application really resulted, like that of the cylindrical ligature, in the rupture of the middle and internal coats of the artery, which tends to substantiate the doctrine of the practitioners of Great Britain. But in the meantime comes Dr. Jameson, of Baltimore, in America, who by new experiments, discredits the principal assertions of Jones. It is not true, says he, that the rupture of the fragile tunics of the artery is advantageous; on the contrary, every exertion should be made to avoid it. Fine threads and round ligatures are dangerous, because they cut the internal and middle membranes, but above all, because they strangulate the *vasa vasorum* of the cellular tunic. Yet he rejects every kind of foreign body, which some would place between the vessel and the bandage, as well as all ligatures of thread of whatever form or volume: strips of untanned deer skin appear to him to be infinitely preferable in every case, since these ligatures possess an elasticity and flexibility which will permit them gently to close and indent the artery without breaking any of its coats, or lacerating the *vasa vasorum*, and which may be safely left in the wound.

Another question naturally connects itself with this discussion. It has been asked, if it would not be possible to substitute for threads of vegetable substance cords formed of animal matter, likely to soften, to dissolve, and be removed by interstitial absorption into the living tissues, without hindering in any degree the immediate reunion of the divided parts. A series of experiments of this description was made in London, in 1815, with silk. One trial in the hands of Mr. Lawrence, and another in those of Mr. Carwardine, met with all the success they could have anticipated. The incision was enabled to cicatrize in the space of four, five, or six days, and the little knot left on the artery occasioned no accident. But other experimenters have been less fortunate; either the immediate reunion has not taken place, or there have been formed small purulent sacs, little abscesses which have not been dried up until after the expulsion, or removal of portions of the silk left in the wound. A patient on whom Mr. Lawrence himself operated on the 29th of March, 1829, was not completely cured until the end of May. Mr. Watson, after he had practised upon a patient this manner of tying the humeral artery, saw the knot of silk tear open the cicatrix, and escape, at the expiration of two months. The same thing occurred under the observation of Mr. Hodgson, at the end of six months; and M. Cumin speaks of a patient who retained this ligature for the space of two or three years. So that, to sum up the whole matter, silk does not appear to be susceptible of removal by absorption.

Sir A. Cooper has completely succeeded with a ligature of catgut. This substance is much more easily dissolved than silk, and would be preferable in every respect, if it were not necessary, in consequence of its slight power of resistance, to allow it a considerable volume. On the first patient the cure was completed on the twentieth day; on the second, who was eighty years of age, the incision required only four days to cicatrize, and in neither case has the ligature ever reappeared. The same success however has not crowned the efforts of Mr. Norman; this physician twice tried the method of Sir A. Cooper, and both times the cure was a long time deferred. Mr. Wardrop, in some of his operations according to the method of Brasdor, has made use of the intestines of the silk-worm, in the shape of thread.

According to Drs. Jameson and Dorsey, Dr. Physick, of Philadelphia, was the first to use ligatures of animal matter, in 1814; those which he prefers are round, and made of deer skin or of catgut; but, like Messrs. Lawrence

and Cooper, he intended to cut or break the arterial coats, while Dr. Jameson desires by all means to preserve them.

The surgeon of Baltimore allows to his deer skin ligatures the thickness of two lines, and increases their strength and firmness more or less, by drawing them between the nails. When applied to the artery, these strips need not be tightly drawn in order to efface its calibre, so that in spite of the absence of a foreign intermediate body they produce the same effect as the ligatures of Scarpa, without arresting like them the circulation in the vessels of the cellular tunic. Dr. Jameson assures us, that after having been pulled between the nails, these ligatures if tightly drawn can cut the arterial tunics in the same manner as the flat ligatures of thread or silk, whilst in their naturally soft and flexible state they are incapable of producing this effect. Dr. H. Levert, of Alabama, in America, has lately published results of a different description. Having remarked that lead, gold, silver, and platina but slightly irritate the parts with which they come in contact, Dr. Physick first conceived the idea of fabricating ligatures of these metals. Dr. Levert seized upon this proposition of Dr. Physick, and subjected it to several experiments. He made five upon the carotid artery of a dog with leaden threads strongly fastened, then cut very close to the knot, and left at the bottom of the wound. Immediate reunion has been obtained at the expiration of the 17th, 18th, 19th, 28th and 42d day; the vessel has constantly been found to be obliterated, and the little circle of lead enclosed in a cellular cyst more or less dense. Three experiments on the carotid, and two on the femoral artery, with gold wire, three others on the femoral, and the two carotids with silver, and three on the carotid with platina, have produced exactly the same effects as the ligatures of lead. Dr. Levert has arrived at similar results by the use of ligatures of waxed silk, of gum elastic, and even with blades of grass.

From these inquiries it results, as I conceive, that the nature and the form of the ligatures in the treatment of aneurisms, are not so important as they have been generally thought for the last thirty years, and that the French surgeons were right in this point of view, in not adopting precipitately, and without reserve, the consequences deduced in England from the experiments of Jones. The large ligatures of Scarpa cause too much irritation in the wound, produce a too extensive suppuration, and require too long a time to elapse before they can be withdrawn, to merit an exclusive preference. This I think cannot be denied; but it is equally true that, by flattening the artery without bending it, they hold the parietes in perfect contact, without necessarily cutting the *vasa vasorum*. The cellular tunic becoming inflamed under such pressure, soon transmits its organization to the two other arterial membranes, and the whole, being speedily blended, form one impermeable cord. The reproaches of Mr. Hodgson, then, are far from being perfectly well founded. When a fine ligature is used in order to break more surely the internal and middle tunics, you compress, at the same time, as is contended by Dr. Jameson, the small vessels of the external membrane, and it is not, as advanced by Jones, by the interior infusion of organizable lymph that the obliteration of the artery is principally effected. On the contrary, the ligature is itself promptly enveloped with a coagulable fluid, the continuity of the small vessels which had been broken is quickly re-established on its external surface, and it finds itself at last in the centre of an organized ring, analogous to that which has been imagined by Duhamel, in the formation of callus for the union of fractured bones. This albuminous ring, the mechanism of which has been followed up by Dr. Pecot, with great

care, in observations on dogs, hardens by degrees, contracts upon itself, and is gradually confounded with the two occluded ends of the artery, after the removal of the ligature. Messrs. Scarpa, Crampton, and Jameson, were then wrong in attributing to fine ligatures a greater tendency to produce secondary hemorrhages than to the flat or large ligatures.

As to ligatures composed of animal substances, it is incontestable that in permitting the incision to close immediately they may be of very great service in practice. It remains to be seen what should be their exact form or nature. If it is desired that they should be very fine, silk alone should be employed, but unfortunately we have seen that this substance will not yield to the interstitial action of the organs—catgut has not the same solidity, nor is it very easily absorbed. Straps of deer skin, which are easily dissolved and possess great elasticity, promise greater advantages, but before adopting them, surgery demands new experiments, and that the results mentioned by Dr. Jameson shall be confirmed by other practitioners. Admitting that when left about the artery these cords do not act as foreign bodies, that the system may be able to appropriate them and will not be obliged, sooner or later to remove them, there is no person who cannot comprehend at a glance the services which they may render to invalids. With them the plastic ring, indicated M. Pecot, would be complete; free from all perforation or interruption, it would be sustained by the exact apposition and immediate reunion of the parts, and would incur no risk of being destroyed by suppuration, or lacerated by the removal of the thread. For the rest, whether the ligature be a little larger or a little smaller; whether the internal and middle tunics be or be not broken; whether the *vasa vasorum* be more or be less completely strangulated, I believe that the definitive results will nevertheless be very much the same.

§ 2. *Permanent Ligature.*

A ligature formed of vegetable materials, tied tightly enough to intercept the passage of the blood in an artery, is a foreign body which will not retire from the incision until it have cut the cord which it encircles. It is necessary, then, in order that hemorrhage may not follow its removal, that the vessel should have had time to close itself firmly, both above and below, otherwise the albuminous *virole* which surrounds it not being of sufficient consistence to resist the blood, and being already open towards the skin, would be immediately swept away. If the ligature, as has been generally believed, produce only adhesive inflammation in the circle of the vessel which it immediately embraces, there would be nothing to fear from the separation, for before it can divide the artery must of necessity be inflamed. But the experiments and reasoning of M. Pecot tend to prove that this is not the case; that the portion of the vessel inclosed by the loop of the ligature almost necessarily mortifies, whatever may be the degree of constriction which it sustains, and that it is only by an eliminating process, analagous to that which takes place in other instances of gangrene, that it is detached from the surrounding tissues.

When this process is not deranged, and when the organic elements upon which it is effected are in the normal state, and where nothing intervenes to prevent the establishment of adhesive inflammation, the ligature is not removed until from the eleventh to the twentieth day; and since by the fourth or fifth day the superior extremity of the arterial canal has become impermeable, there is on this point no occasion for anxiety. But if unhappily the parietes of the vessel are soft, steotamatous, yellow, or inflamed, the ligature will

have mechanically divided them; if the channel is not completely closed, they will ulcerate without interrupting the current of the blood: and again, if they are hard, and incrusted with calcareous concretions, as they frequently are in aged persons, it is easy to see that the inflammation which can be excited in them will be most frequently of too low a grade, and too irregular to occasion the necessary effusion of concrescible material, either on the exterior or the interior, and that however long deferred, the coming away of ligature may produce a serious hemorrhage.

§ 3. *Precautionary Ligature.*

In order to obviate such unfortunate results, have been invented precautionary ligatures; that is to say, cords which only become useful in case that which has been first applied has effected the division of the artery before it has been perfectly obliterated. One of these ligatures was carried round the vessel without being tightened, a few lines below the principal ligature; a second, composed of two separate strands, was placed a little above the inferior portion, to be tied in such a manner as not to close up the arteries, but only to deaden the impulse of the column of blood against the point which it is intended to obliterate; a third, also double, was placed still higher, and this latter, the same as the superior strand of the preceding, was left loose. In case the fixed ligature should fail, the first pair of the upper precautionary ligatures would be tied, and subsequently, in case of need, all the others, in order to stop the hemorrhage.

The same was done with the two portions of the inferior ligature, which has no other object than to oppose the reflux of the blood through the incision. This was the reasoning and the practice of A. Monroe, Guattani, Hunter, Desault, Deschamps, Pelletan, and even for some time of Mr. Boyer. At this time, precautionary ligatures have almost entirely disappeared. So far are they from being considered useful, that they are denounced as being very dangerous; they were at first reproached, and justly, with irritating the incision too highly, with continuing suppuration, and with opposing an insurmountable obstacle to immediate reunion. Besides, Messrs. Dupuytren and Beclard have demonstrated, that during the inflammation, the point of the vessel near which they lie assumes a fatty consistence, is extremely easy to cut, and entirely incapable of supporting the action of any ligature whatever; whence it follows, that their mere presence is enough to occasion the ulceration of the artery, which they divide with the same facility as lard or cheese, as soon as it is necessary to exert the slightest force in the way of constriction.

§ 4. *Temporary Ligature.*

Not only have the precautionary ligatures been rejected, but it has been inquired whether it would not be possible, without affecting the success of the operation, to remove the only ligature which may be employed before it has had time to cut the vessel. It is near thirty years since the examination of this question was began in England. Jones is said to have found, that in breaking at three or four points at some distance from each other the internal and lesser coats of an artery, with as many fine threads, a lymphatic effusion was produced which was sufficient to determine the obliteration sought for, and permitted the removal of the ligatures in a few minutes. The results obtained by Mr. Hutchinson fully confirm those of Jones; but Dalrymple, Hodgson, and Travers, have been less successful. Their experiments have been

tried upon horses and sheep, and the artery has never been found obliterated. It was only slightly contracted when the animal was killed, after the lapse of 13, 15, or 18 days. Mr. Travers, however, thought that this suggestion might be rendered available by a slight modification. Instead of removing the ligature immediately after having closed up the artery, he resolved to leave it tied until sufficient time should have elapsed to permit the clotted blood and the lymphatic effusion to acquire a certain degree of firmness and consistence, which would render it capable of resisting the force of the blood. His experiments upon horses have led him to the conclusion, *that a ligature continued for six hours, two hours, or even one hour, upon the carotid, will commonly result in a permanent obliteration of the arterial canal.* In 1817, he applied a ligature upon the brachial artery of a man, and withdrew it fifty hours afterwards without the pulsation being restored in the tumor. Mr. Roberts has gone still farther; a ligature which he left only twenty-four hours on the femoral artery of a sailor affected with popliteal aneurism, was sufficient to effect a complete cure in twelve days.

In repeating these experiments, unfortunately the same successful results have not always been obtained. Mr. Hutchinson has seen the circulation immediately re-established in the femoral artery, although it had been firmly tied with a ligature for the space of six hours. The same thing has occurred to Sir A. Cooper, after thirty-two and forty hours. Mr. Travers himself, upon withdrawing the thread which he had left upon the artery of the thigh for twenty-five hours, has seen the pulsation reappear by degrees in the aneurism, refuse to yield to a long-continued mediate compression, and occasion the necessity of at last applying a ligature in the ordinary way, so that he finally relinquished this practice, which the experiments of Beclard had prevented from being adopted in France.

At the very time when the temporary ligature lost its warmest partisans in London, the surgeons of Italy took it up. Scarpa subjected it to new trials, and endeavored to establish it in general practice. Flat ligatures tied over a small cylinder of waxed cloth upon the carotid arteries of several sheep, and withdrawn on the third, fourth, or fifth day, always produced the complete obliteration of the cavity of the vessel. These experiments being repeated on horses by M. Mislei, veterinary surgeon at the school of Milan, produced exactly the same results. Upon the human body the success of this practice has not been less happy. Paletta communicated to Scarpa two remarkable examples. The first subject was a man of forty, who had been affected for two or three months with an aneurism in the ham. The ligature was applied upon the femoral artery on the 8th of January, 1817, and removed on the 12th. The second instance relates to an invalid, sixty years old, with an aneurism in the bend of the arm; a ligature placed on the humeral artery was withdrawn on the fourth day, and, as in the case of the first individual, the operation resulted in success. A popliteal aneurism, treated in the same way by M. Biraghi, had the same termination. The same is true of a fourth individual, on whom the humeral artery had been opened, and who had applied for assistance at the hospital of Pavia. Messrs. Molina, Fenini, Maunoir, Wattmann, Fitz, Medoro, Solera, Roberts, Falcieri, Uccelli, Giuntini, and Malago, have also used the temporary ligature with success in the treatment of aneurisms of the carotid and femoral arteries. Vacca objected, that after the removal of the ligature, the artery is, notwithstanding, sooner or later divided. The experiments of M. Pecot, opposed to those of Mr. Seiler, tend to confirm this opinion, which nevertheless, takes nothing from the weight of the facts and reasonings of Scarpa.

Operative Processes.

The difficulty, as is shown in a case related by Mazzoni, consists in removing the ligature, without drawing upon the artery or disuniting the lips of the incision. Viewed in this light, all the means employed in England appear faulty. The two single threads previously laid by Messrs. Paletta and Roberts between the vessel, or the little roll and the tape which serves as a ligature for the purpose of untying the latter in drawing them out, effect the object but very imperfectly. The same may be said of the bit of a grooved director which M. Uccelli tied in the same tape with the roll of cloth, and upon which he proposed afterwards to cut the knot. M. Giuntini contents himself with attaching to the end of the cylinder, or roll, before it is fixed upon the artery, a waxed thread, by which it may afterwards be withdrawn so as to render the cutting of the ligature more easy. For all these modes Scarpa substituted the following:—

1. *Process of Scarpa.*—A grooved probe, notched at its extremity, and furnished with two small flat rings on one edge, the one about half a line from the point, the other about an inch from the handle, serves to conduct a very small knife down to the ligature where it surrounds the artery; the mode of using this little apparatus is very simple. The end of the ligature which has been kept outside, is successively passed through the two rings which are intended to receive it. The beak of the director is then carefully directed to the little roll of linen which arrests its progress; the knife then penetrates as far as the ligature, which it cuts across, and which can then be withdrawn without the least danger to the vessel. For further details of this ingenious process, consult the article inserted by M. Ollivier in the second volume of the *Archives Generales.*

2. *Process of Deschamps.*—In France also, some attempts have been made with the temporary ligature, but after a different manner; that is, in combination with immediate compression. In 1793, Deschamps invented his *presse-artere*, that is to say, an instrument composed of a flattened metallic wire, about three inches in length, notched at its free extremity, and terminated at the other by a horizontal plate resembling the head of a nail, flat, rather long than wide, and pierced with two slits near the edges. The operation is commenced by passing the ends of the ligature, which has been placed under the vessel, through the two holes in the instrument. The surgeon then draws upon these, and at the same time presses down the head. Thus the trunk of the vessel is held flat, between the tape and the flat extremity of the *presse-artere;* the one drawing it forwards, and the other pressing it backwards. Lastly, the ends of the ligature are fastened upon the notch of the instrument.

The small canuli used by Assalini, the compresses tried or recommended by Forney, Flajani, Buzani, Garnery, Ayzer, Crampton, Ristelhueber, Deaze, and others, although differing in some respects from that of Deschamps, have yet been all constructed after the same idea; that is to say, with the intention of flattening instead of pursing up the vessel, and of withdrawing the ligature at a given time. Like it also they are attended with the inconvenience of irritating the wound, and of promoting the ulceration of the artery, which they too often but incompletely close.

3. *New Process.*—If any just conclusions may be deduced from experiments made upon dogs, the following process will prove to be means as easy of employment as certain of success, for obtaining by means of temporary ligatures the obliteration of arterial canals. A common pin is passed under the artery, the two extremities of which are then encircled by a loop of thread,

as in the twisted suture, which is made sufficiently tight to prevent the passage of the blood. A second thread attached to its head, allows the removal of the pin whenever it is thought expedient. The ligature thus released, no longer offers the slightest resistance, but drops out almost of itself. The process employed by M. Malago, and which consists in twisting the two heads of the ligature instead of tying them, would be more simple, it is true, but it would not possess the same degree of certainty.

4. *Process of M. Dubois.*—The idea which suggested to Deschamps the construction of his *presse-artere*, that is, of obliterating the vessel only by degrees, was adopted by M. Dubois, who endeavored to found upon it a new method of treating aneurism. In 1810, after having placed the ligature around the artery, this practitioner then passed the extremities through the *serre-nœud* of Desault, in such a manner as to gradually intercept the course of the blood, and only to effect the complete obliteration of the arterial calibre after six or eight days. His intention in following this plan was to permit the supplementary branches to dilate gradually, and to prevent the gangrene, which at that period was thought to be a necessary consequence of suddenly tying a large artery. The two instances of success mentioned by M. Richerand, and which were obtained by this process at *La Clinique de la Faculte*, at first forcibly attracted public attention; but a third attempt being followed on the fifteenth day by a hemorrhage, which required the amputation of the limb, and finally caused the death of the patient (although the pulsations had ceased to be discoverable in the tumor by the tenth day), soon put an end to these gratifying expectations. Since then (the close of 1810), I have no knowledge that recourse has been again had to this mode of procedure, notwithstanding the two successful cases of MM. Viricel and Larrey. Now that we are able to set a just estimate upon the dangers of suddenly suspending the circulation in the principal artery of a limb, a process of that nature has deservedly lost all value, and what I have said concerning the precautionary ligatures, is enough to show that they are the most dangerous contrivances which can be proposed.

§ 5. *Two Ligatures with intermediate division of the Artery.*

Galen, Aetius, Celsus, Guy de Chauliac, Rufus, Rhazes, Gouey, Severin, and others, were in the habit of applying two ligatures at some distance from each other, and then dividing the artery between them. Pelletan, following the suggestion of Tenon, was upon the point of imitating this practice, which had been completely forgotten about the close of the last century, and which Heister, Callisen, and Richter, have strongly reprobated. Abernethy adopted it for his first ligatures on the external iliac artery, not knowing that his countrymen Bell had already spoken of it, but believing himself to be the inventor. With this precaution, says he, the two ends of the artery are retracted into the flesh, without being subjected to any dragging, and are in the same condition as in the case of amputation. M. Maunoir, who published in 1802 a treatise on this modification, which he also regarded as his own, has declared himself its defender. With Morand, he concedes to the arteries a great retractile power; believes that in pursing them up the circular ligature shortens them, disposes them to be violently pulled by the impulse of the heart at the throb of every pulsation, and that the best means of preventing secondary hemorrhage, is to permit the artery which has just been tied to retire into the soft parts as far as its natural retractility requires. Some facts cited by Messrs. Abernethy, Black, A. Cooper, Maunoir, Dalrymple, Post, Guthrie, and others,

seemed at first to confirm the eligibility of this method, which Messrs. Roux, Larrey, Lisfranc, and Taxil, in France, were very much disposed to adopt, at least for the great arteries. But on being tried in 1807, by Mr. Norman, of Bath, it gave rise to a very troublesome hemorrhage, and Scarpa, who, condemning it, advances the observations of Monteggia, Assalini, and others, when it was attended with fatal hemorrhage.

It is certain that the reasonings on which they rely in dividing the arteries between the two ligatures, are ill grounded. The retractility imagined by Morand and M. Maunoir, and upon which Messrs. Beaufils, Taxil, Saint Vincent, and more recently Mr. Guthrie, have so earnestly insisted, scarcely exists, as has been proved by the experiments of Beclard, and as I have several times been able personally to convince myself. If after the amputation of limbs the arteries retire sometimes very far, it is because they are drawn away by the muscles and not by any contractility inherent in themselves. Then even supposing that being indented by a ligature they undergo some stretching, nothing is more simple than to pick an end to this without breaking the continuity of any tissue. It is sufficient for that purpose to follow the advice given by Lyng, that is, to place the member in a semiflexed position, and all the muscles in a state of relaxation. Not only is there no appreciable advantage to be gained from this division of the artery, but it also exposes you to the greatest danger. If the ligature of the superior extremity of the artery for example, should get loose, or should become relaxed, as has happened in the practice of Messrs. A. Cooper and Cline, an alarming hemorrhage will of necessity result, capable of becoming quickly mortal if the patient is not instantly relieved. Should a similar accident happen after ligature of the carotid artery in the inferior region of the neck of the subclavian, or of either of the iliac arteries, death will be the almost inevitable consequence. We must then conclude that the advice given by Abernethy and Maunoir, to place two ligatures on the great arteries and then to cut the vessel in the interval, is a method dangerous in its consequences and of no avail in regard to the end proposed.

§ 6. *Ligature through the Artery.*

For some time past there has been an endeavor to bring forward a process mentioned by Dionis, and described by Richter in the following terms:—"The artery," says he, "after having been drawn to the outer side, should be encircled twice with an ordinary ligature, which should be fastened by a knot, and when the artery is of any considerable size, one of the ends of the ligature should be passed through it by means of a needle. It is this manner of operating which Cline thought proper to recommend, in order to prevent the ligatures used after the manner of Maunoir from relaxing and slipping from the ends of the artery. Sir A. Cooper made trial of it upon a subject twenty-nine years of age, in operating for an aneurism in the popliteal region. The two ligatures were first tied at the bottom of the inguinal region; the needles were then passed through the coats of the vessel between the two ligatures, and the ends of both the threads were then attached to the knots of the first ligatures, with the intention of preventing the possibility of slipping. Mr. S. Cooper, and all other surgeons, have condemned this procedure, and I think with reason, for it has neither analogy nor experience in its favor, nor could any thing justify its employment. Yet it may have given birth to that operation which Dr. Jameson appears to have practised several times with success. This physician thought that to transfix a large artery or vein with a seton, two or three

lines in size, would be sufficient to determine its obliteration; the experiments made by him on the carotid, and jugular veins of horses, have always produced an effusion of plastic lymph in the interior of the vessel, a thickening of the divided parietes, and soon after a complete interruption of the course of the blood. I learn from Dr. Chumet, of Bordeaux, that these experiments having been repeated at *Val-de-Grace*, gave the same results. From a communication of M. Carron du Villards, it appears that he too has made experiments on animals, which demonstrate that the same end is obtained by piercing the artery with a linen thread or with a wire of iron, steel, or silver, &c. so that a new question here presents itself, which in my view merits the attention of practitioners. A strip of skin, or a conical wire, or shank of some metallic substance, being left at the extremity of the wound, would not in any degree hinder its immediate reunion, and would render the operation for aneurism exceedingly simple, if the cure would as surely follow this method as it does the application of the ligature.

§ 7. *Mediate Ligature.*

The ancients, not possessing the necessary anatomical knowledge, did not give themselves the trouble of finding the artery, but contented themselves in some cases with piercing the whole thickness of the limb between the vessel and the bone, and then tying up the two ends of the cord over a compress placed between the ligature and the skin. This is the process recommended by Thevenin, and the process which Le Dran and Garengeot did not disdain to follow in the beginning of the last century, in order to suspend the circulation of the brachial artery whilst they amputated the shoulder. Although surgeons may sometimes have succeeded by this absurd method in the cure of aneurism, I do not think it necessary in our day to discuss it at greater length to point out its disadvantages and its dangers.

§ 8. *Immediate Ligature.*

On proceeding to search for the artery at the bottom of the aneurismal sac or bag, it was sometimes so difficult to isolate it from the surrounding tissues, that the question arose whether it would not be right at the same time to comprehend within the ligature the accompanying veins, or nerves.—Molinelli sustains that it is useless to take so many precautions, and that the inclusion of the great nervous cords rarely effects the success of the operation. Thierry has arrived at the same conclusions, after having made sundry experiments on dogs, sometimes tying up the axillary and femoral artery without touching the nervous plexus, and sometimes including it with the thread, and no case whatever resulted in either gangrene or permanent paralysis. The moderns, nevertheless, have rejected this practice, and consider that, except in cases of insurmountable difficulty, the artery alone should be confined by means of the ligature. An observation is extracted by Pelletan from a letter of Testa, in which it is seen that a patient, treated by Falconnet, who had included in the same ligature the nerves, the vein, and the popliteal artery, was immediately seized with horrible pains in the limb, which mortified in the evening of the same day. Even if this case will not compel us to conform to the practice of modern surgeons, reason itself, unassisted by such dreadful experience, should suffice to bring us to the same result. It may indeed be conceived that the division of one or more of the

nerves of a part will not necessarily produce paralysis: and it may be conceived, too (notwithstanding the opinions of Mr. Guthrie), that the ligature of a great vein need not of course be attended with gangrene, but if both these kinds of organs be included in a ligature at the same time with the principal artery of the same limb, it cannot be doubted that mortification and loss of feeling must take place, if not always, at least in the greater number of cases. It is evident besides, that in advising us to pay no attention to organs of such importance, the surgeons have desired to justify their want of care in isolating the artery. At the present day it is customary to exclude from the ligature every vein, and every the smallest nervous cord, and every particle of the surrounding tissues; and this practice is, without doubt, one of the reasons why the operation for aneurism, heretofore so formidable, is now so simple and so easy.

Since precautionary ligatures have been rejected, some persons have thought, that for greater security it would be well to apply upon the great arteries two ligatures at some distance from each other. Vacca observes that nothing is gained by this procedure, inasmuch as the portion of the vessel between the two ligatures necessarily gangrenes. But this reason of the Professor of Pisa cannot now have weight; for Mr. Briquet reports, upon the authority of Beclard, that a segment of artery may very well continue to live, although it have no longer any communication with the trunk from which it has been separated. It should then be for other reasons that we proscribe the double ligature.

Art. 6.—*Methods of Operation.*

A. Aetius says, that in order to cure aneurism you must expose the artery above the affected part, tie it in two places, then cut across, open, and empty the aneurismal cyst; raise the vessel, tie it above and then below the opening, and cut it a second time across.

B. Paulus Ægineta speaks of a process which consists in passing, by means of a needle, a double ligature behind the centre of the aneurism, to bring back one of these ligatures to the upper, and the other to the lower part of the tumor, which is thus strangulated above and below. It is then opened and almost completely removed. Thevenin also mentions this process, which is evidently nearly the same with that formerly employed for the removal of wens, and several other tumors. It is to him, no doubt, that Guy de Chauliac refers, when he asserts that aneurism can be cured by employing the ligature, *a mode de rompure.*

C. The last-mentioned author describes another method, which although it approaches that of Paul of Egina, would yet seem to differ from it in some respects, and in reality to be more rational. "It is necessary," says he, "that the artery should be exposed in both directions, and tied with the thread; the part remaining between the two bands should be cut, and then treated in the same manner as ordinary incisions." The process so elaborately described by Bertrandi, about the middle of the last century, being nothing more than a repetition of that of Guy de Chauliac, does not deserve further notice in this place. It is, besides, so far from being new, that even Philagrius had had recourse to it.

D. Guillemeau, the competitor and disciple of Pare, simplified the method of the ancients. He contented himself with tying the artery above the tumor, opening the latter, removing the coagula, and then dressing it as a common wound. This formed the basis of the old method of treating aneurisms; a

method which, until the last century, was never applied except in cases of aneurism of the bend of the arm.

E. Keisleyre, a surgeon of Lorraine, in the Austrian service, is the only one who, about the year 1644, had ventured to practice it several times for popliteal aneurism. Instead of beginning with the exposure of the artery above the tumor, Keisleyre, after having suspended the course of the blood in the member, by the assistance of the *garot* or of the tourniquet, opened the whole length of the aneurismal bag, cleansed it carefully, sought out the opening in the artery, introduced by it the end of a sound, so as to raise the trunk, tied its superior portion, compressed the inferior, and then treated the wound by the customary means. A century after the time of Keisleyre, Guattani, Molinelli, Flajani, and almost all the surgeons of Italy, employed the same method, which was not long of being generally adopted in France, Germany, and England, after having undergone at different times some slight modifications.

F. Instead of merely compressing the inferior extremity of the artery, Molinelli, Guattani, and others, found it most prudent to encircle this too with a ligature. The two Monros, Hunter, Desault, Pelletan, Deschamps, and Boyer, believed that it would also be useful to leave some threads above and below the former, to be used in case of necessity to arrest consecutive hemorrhages. Hence arose the use of the precautionary ligature, which has been already discussed.

G. A method different from this last, and of which the elements are found in Aetius and Guillemeau, was introduced into practice in the beginning of the last century by Anel. Having to treat an aneurism on a missionary of the Levant, on the 30th of January, 1710, Anel applied, in the presence of Lancisi, a simple ligature to the humeral artery immediately above the tumor, without touching the cyst. On the 5th of March following the patient was cured. Nevertheless, this result, however remarkable, did not at first attract attention, and was not rescued from oblivion until somewhere between 1780 and 1786, when Desault endeavored to bring it again into notice in the month of June, 1785. He tied the popliteal artery without opening the aneurismal sac. On the 19th day a large quantity of matter mixed with blood escaped from the wound, and in a short time after, the cure appeared to be complete; but the patient sunk about the seventh or eighth month.

According to M. Martin, of Marseilles, Professor Spezani had conceived, early in the year 1781, the project of tying the femoral artery without touching the sac, in cases of popliteal aneurism. In the month of December, 1785, Hunter carried this project into execution. His operation, being completely successful, caused a great sensation in the surgical world, and was really the signal of an entire revolution in the theory of the treatment of aneurisms.

After this period the method of Anel has been described as the "new method," the "modern method," the "method of Desault," or of "Hunter," neither of which denominations is justly applicable, and all of which should yield to the name of "the method of Anel," its actual inventor.

H. A last method has just been introduced into the science. Arrested by the difficulty or the impossibility of applying a ligature betwixt the aneurism and the heart, and by the dangers of opening the sac when the disease is situated too near the trunk, yet unwilling to resort to the method of Valsalva, or to topical refrigerants, some surgeons have thought it feasible to tie the vessel between the tumor and the capillary termination of the artery. According to M. Boyer, it is to Vernet, a military surgeon, that we should

ascribe the suggestion of this idea, since he first tried the compression of the femoral artery below an inguinal aneurism. Brasdor is not the less the first who formally proposed to place the ligature in that situation. Desault afterwards advised the same method, and Deschamps put it in practice in the case of a very voluminous aneurism in the bend of the arm, which threatened to burst. The palpitations soon became much stronger in the tumor, which it was found necessary in a few days to open very freely, and the patient died in consequence of this operation, after having lost a considerable quantity of blood. From that time the proposition of Brasdor seemed to have been definitively condemned, was pronounced to be absurd, and was generally rejected as dangerous. The experiment of Deschamps seemed to confirm fully the fears which had been suggested by reasoning *a priori*. It had been said that upon tying the artery on that side of the cyst, the blood being arrested at this point by an insurmountable obstacle, would distend the aneurismal tumor with more violence than ever, render the parietes thinner, and finish by bursting a passage through them. But Sir Astley Cooper, convinced, like Brasdor, that the circulation when suspended in the artery below the tumor, would turn aside by the collateral branches, to return through the inferior portion of the limb, but would stagnate and occasion coagula in the tumor itself, and all that part of the vessel which lay between the ligature and the first considerable branch given off in the direction of the heart, thought it not right to yield to the above reasoning. With these views he ventured in 1818 to repeat the experiment of Deschamps on an aneurism which pushed upwards Poupart's ligament, and appeared to occupy a great part of the iliac fossa. The pulsation in the tumor continued, but the progress of the disease was arrested. At the expiration of some time, the tumefaction of the neighboring parts disappeared; the coming away of the ligatures was not followed by any accident; the wound cicatrized, and about the sixth week he sent the patient to pass the period of convalescence in the country. They learned afterwards that the tumor had broken, and that the man had expired about two months after the operation: the body was not opened. Notwithstanding this unfortunate result, Sir A. Cooper's operation was still capable of exciting some hope, and of giving rise to new experiments. M. Marjolin, in 1821, says, that before this method should be entirely abandoned, new experiments ought to be made, particularly on the primitive trunk of the carotid. M. Pecot has positively advised its adoption (since 1822), in certain cases of aneurism of the primitive and external iliac arteries, and even of the subclavian, when the volume or the disposition of the tumor prevents the exposure of the artery, by the method of Anel; the collateral branches which may exist between the principal ligature and the sac, should be at the same time secured. M. Casamayor also says, in his thesis (in 1825), after having reviewed the facts and arguments cited for and against the method of Brasdor, that it may be employed with success in cases of aneurism, where it is possible, by this means, to suspend the current of the blood, or to reduce its column to a size insufficient to prevent the contraction of the tumor. M. Dupuytren has long said, in his lectures at the Hotel Dieu, that the partial success obtained by Sir A. Cooper should incite rather than repress the zeal of surgeons, and that by restricting the patient to a close regimen, and diminishing the mass of the fluids by frequent blood-lettings, either before or after operation, its success would, in all probability, be favored. Things were in this state, when, in spite of the reasonings of A. Burns, Hodgson, and many other English authors, Mr. Wardrop, in 1825, resorted to the method of Brasdor in a case of aneurism of the primitive carotid. This operation was

performed on a woman seventy-five years old, on whom the tumor, being situated close to the *sternum*, would not permit the passage of a ligature between itself and the heart. On the fourteenth day the aneurism was diminished one half; pulsation in it ceased, and it at last broke and emptied itself like an abscess. The ulcer was promptly cicatrized, and the patient recovered.* In the course of the same year, Mr. Wardrop had occasion to treat another woman, aged fifty-seven years, for an aneurism situated exactly under the sterno-mastoidean muscle of the right side. On the 10th of December, in the presence of Mr. Lawrence, the carotid artery was tied with a ligature formed of the intestines of the silk-worm; on the 13th the wound was found to be entirely closed, and on the 21st the patient was believed to be entirely cured. She sunk on the 23d of March following, but with all the symptoms of hypertrophy of the heart, and of accidents which could not be said to have any connection with the operation itself. On the 1st of March, 1827, Mr. J. Lambert, of Walworth, took occasion to imitate Mr. Wardrop, in a case of aneurism of the right carotid, on a woman of forty-nine years of age. On the third day the tumor had greatly decreased in size, and presented only slight pulsations. On the tenth day came on a hemorrhage, which, however, did not prevent the wound from closing. The tumor soon after disappeared. On the 17th of April the cicatrix opened, and a fleshy lump was found to occupy the centre. On the 18th a new hemorrhage occurred; was several times repeated between that day and the 30th, and on the 1st of May became so abundant that the patient expired.

On examination of the body, it was perceived that the carotid artery was ulcerated above the ligature; that the aneurism was entirely obliterated, and that the hemorrhage was attributable to the reflux of the blood from one carotid artery through the other. Mr. Bushe, of New York, performed, on the 11th of September, 1827, a similar operation on a woman, thirty-six years of age, with complete success. Mr. Wardrop practised it for the third time, on the 6th of July of the same year, on a lady of forty-five years of age. On this occasion, he tied the subclavian artery instead of the carotid, which was not the seat of any pulsation, and which appeared to be obliterated. One month after the patient left London, in order to recruit her strength in the country, and towards the end of August was completely restored. Various symptoms of disease in the chest afterwards occasioned some uneasiness: on the 9th of September, 1828, her health was as good as it ever had been; yet she died on the 13th of the same month, in 1829. On the 2d of July, 1828, Mr. Evans, of Belper, in his turn, operated, upon the plan of Brasdor, upon a patient aged thirty years, for an aneurism of the trunk of the carotid artery, and on the 28th of October the patient returned to his usual avocations. The disease afterwards reappeared, and it became necessary to perform a new operation; to tie two tumors and excise them. The patient was finally cured. (Letter of Mr. Evans to M. Villardebo, May, 1831.) A negro, treated in the same manner, on the 10th of March, 1829, by Mr. Montgomery, of the island of Mauritius, appeared to have been cured, but died on the 11th of July following. Dr. V. Mott lost a patient on the 22d of April, 1830, upon whom he had operated on the 20th September, 1829, and whom he had believed to be cured. A woman operated upon by Mr. Key, expired during the course of the same day. Lastly, an attempt of the same kind was made on the 12th June, 1829, at the Hotel Dieu, by M. Dupuytren, in case of an aneurism at the origin of the right subclavian artery: the patient died on the ninth day after the operation,

* Was it really an aneurism?

rather, perhaps, in consequence of profuse hemorrhages than immediately from the operation itself. Messrs. White and James, who have imitated Sir A. Cooper, have not been more successful. There are then, these three methods of treating aneurism by ligature; and it only remains to be determined which should be generally preferred, and in what cases it will be advisable to have recourse to the other two.

Relative value of the three principal methods.

By the *old method*, or that of Keisleyre, it is necessary that the situation of the tumor should permit the introduction, between it and the heart, of a sufficient compression to suspend for a time all circulation in the limb. The opening of the sac requires very extensive incision; involves a large suppuration; renders the isolation and the ligature of the artery sometimes very difficult; frequently requires the thread to be placed on a part of the artery more or less diseased; especially exposes the patient to the dangers of consecutive hemorrhage, and of gangrene by default of circulation; and is extremely slow of cicatrization.

By the method of Anel, on the contrary, we deal with tissues which are in their normal state, and of which the relations have not been disturbed. It is easy to exclude every thing but the arterial trunk from the loop of the ligature, leaving untouched the nerves and veins, and all other tissues, the inclusion of which might endanger more or less the success of the operation. The previous compression of the vessel is not indispensable: the incision is clean, of slight extent, and quickly and easily cicatrized. The operation is simple, easy of execution, much less painful, and less protracted than the other method; and the artery not having been opened, and being tied at a point perfectly sound, secondary hemorrhages are less to be feared, and much less frequent. As the continuity of the tissues is not so much interrupted, the circulation establishes itself more easily below the ligature; the reaction in the general system is naturally less powerful, and the gangrene of the member less to be apprehended. But by the opening of the sac, the thread can be applied as low as possible; the tumor is immediately emptied; a new disease is not added to the original one; and all the collateral arteries which are given off above the aneurism, are preserved. Tumors situated too near to the trunk to allow of operation by the method of Anel, permit the tying of the two portions of the artery at the aneurism. Again, if an arterial trunk has just been wounded, and the place of the opening is known, it appears more rational in the first instance to expose it at this place, than to endeavor, by inflicting a new wound, to seek for it higher up. These, at least, are the reasons which have been advanced, and which Mr. Guthrie still adduces in favor of the method of Keisleyre. In order to repel these arguments, the partisans of Anel assert, that after the ligature of an artery the circulation ceases, not only in the point nearest to the bandage, but as far back as the first considerable collateral branch given off in the direction of the heart; so that in placing a ribbon on the popliteal artery, the femoral itself is obliterated as far as the beginning of the profunda, which shows that there is no advantage to be gained by discovering this vessel in the inferior third of the thigh. Then, in regard to tumors which are very near the origin of the limb, there is nothing at the present day which can render the method of Anel inapplicable, when they are susceptible of the operation of opening the sac. In diffused aneurism it cannot be denied that the embarrassment produced by the effused blood, the

displacement and disorganization of the tissues, the difficulty of immediately hitting upon the wounded part, and even of finding the vessel itself at the bottom of a wound more or less irregular, and the depth to which this wound must in some cases extend, present obstacles which certainly justify the practice of those who even then operate at a higher point upon the limb, especially since any hemorrhage, which might return by the inferior portion of the artery, could be easily arrested by compression properly applied.

Those who oppose the method of Anel, say, that in placing a ligature at some distance from the seat of the disease, the blood and pulsations are likely to reappear in the cyst, and thus a grave operation will have been performed absolutely to no purpose. Very often, it is true, the pulsations are revived in the aneurism a short time after the application of the ligature, according to the method of Anel; the blood may return by anastomatic arches into the portion of the arterial trunk comprised between the tumor and the ligature, and enter into the aneurismal sac by its inferior opening, or perhaps arrive there directly by some secondary branch; but experience has sufficiently demonstrated that these pulsations very soon cease, or at least, that a moderate compression is generally enough to put a stop to them. Reason, too, perfectly explains this result. The blood which enters into the aneurism cannot do so under such circumstances, without having traversed the capillary system, having passed through very fine ramifications into the larger branches, and having consequently lost a great portion of its ordinary impetus. Now, as it is sufficient to determine the coagulation, that the blood should remain in a state of oscillation or of stagnation, that it should cease to circulate in any point of the vascular system, it is easily seen, that the disadvantage in question is far from having the importance originally ascribed to it. With regard to the consecutive opening of the cyst, its suppuration, and inflammation, which have been thought capable of endangering the success of the method of Anel, they are circumstances generally too trifling to require attention, and which, even when they prove otherwise, render the operation after all less serious than that of Keisleyre; they are hardly ever seen except in cases where the disease is much advanced, or the aneurism enormous and enclosed by very slender parietes more or less disposed to mortification. The method of Anel, then, possesses numerous and undeniable advantages over the ancient method. Some persons, however, still persist in believing that this latter should not be entirely rejected, and that it should be preferred, for example, in cases of superficial diffused aneurism; those which occupy the brachial artery immediately in the vicinity of the armpit; those of the axillary itself, when the shoulder is infiltrated, or so much distorted that it would be dangerous to attempt the operation, either before or above the clavicle; in aneurism in general, when it is very voluminous or threatens to gangrene, or is seated near a large and important collateral branch; and in varicose aneurism, which imperiously demands, as we are assured, that the artery should be tied both above and below its opening. This doctrine which is supported with great zeal by Mr. Guthrie, appears to me to be very just, and altogether conformable to the principles of sound surgery; several facts, among which are the ligature of the femoral artery, and a similar operation on the external iliac, which will be mentioned in their proper place, have demonstrated to me the truth and justness of this position.

The *method of Brasdor*, which is but a modification of Anel, possesses consequently, as an operation, the same general advantages and disadvantages. It is nothing more, however, than a make-shift, a last resort, applicable only to cases which do not permit the employment of either of the others

The cures obtained by this method, are explained in the following manner: the blood circulates with less force in the aneurism than above and below, according to a well-known law of hydraulics. With this predisposition, the first effect of a ligature applied to the portion of an artery which brings the blood to the aneurism, should be to arrest the circulation first in its cavity, and afterwards, as far back as the supplementary branches by which the blood can deviate from its usual course.

If the carotid, for example, should be tied near its bifurcation, it would be obliterated step by step to its very origin; that is to say, to the point where it leaves the aorta or the subclavian. It is the same with the tibial, radial, cubital, popliteal, brachial, and femoral arteries, respectively; but if it is sufficient to close an artery towards its capillary extremity in order to efface the canal, it is evident that the aneurism, being situated between these two points, would disappear almost as easily and as surely when the ligature was used below, as if it had been carried above the seat of the disease. It may be presumed, that according to the method of Brasdor, the pulsations would less frequently reappear or be maintained in the cyst, than by the method of Anel, unless one or more considerable collateral branches should be given off between the ligature and the lesion. In this latter case, the operation will without doubt have a less chance of success; but still it appears to me likely to very often succeed, provided the supplementary branches should be two or three times less in calibre than the principal trunk, and do not allow the blood a sufficient passage of deviation to prevent its stagnation in the aneurismal sac; and provided the parietes of the latter should preserve sufficient density to resist the efforts of the tumultuous throbbings, which it generally has to sustain immediately after the operation.

The value of the new method should not, however, be exaggerated. Of fourteen subjects who have submitted to its application, eleven have died and the twelfth has incurred the most imminent danger. A multitude of facts scattered through the annals of the science, prove that the arteries are far from being always obliterated to a great extent above the ligature. Warner quotes a case of brachial aneurism which supervened upon amputation above the elbow, and which it was necessary to treat by tying the vessel towards the armpit. An amputation of the leg presented the same phenomenon to M. Roche, in 1813, at Tarragona, and it was necessary to tie the posterior tibial between the aneurism and the popliteal artery. Two instances of aneurisms have been presented by Mr. Hodgson, which were closed at their inferior origin, and which, nevertheless, burst or mortified. Mr. Guthrie says, that several preparations in Hunter's collection, show a complete obliteration of the artery beneath the bag, without a cure of the aneurism. In proceeding to the ligature of the external iliac, according to the method of Brasdor, Mr. White found the artery impermeable, and yet the aneurism continued to increase, and I have at this time under my own observation, a woman who undertook a month ago amputation at the knee, in whom the popliteal artery has not yet ceased to beat strongly at the bottom of the wound; and who has not witnessed the same phenomenon in all similar amputations? Now, if the arterial cyst continues below the origin of the collateral branches, and at the distance of one or two inches from the suppurating surface of an amputation, or from the spontaneous obliteration of the vessel, it is difficult to see why it must be otherwise after the formal application of the ligature.

Art. 7.—Manual.

Is it necessary, before practising the ligature of an artery, to subject the patient to any preparatory treatment? Is it necessary to wait for an advanced period of the aneurism? Or is it better to operate as soon as its existence is well ascertained? The preparatory compression recommended with the design of favoring the development of the supplementary vessels, is wholly unnecessary. It has of late been generally abandoned, and it is not, in fact, proper to employ it, except in cases where it offers some chances of being of itself a means of cure. According to the old method, there was no risk in delaying the operation. The partial interruption of the course of the blood, produced by the development of the tumor, would naturally render the collateral circulation more and more free, and allow the hope of a certain number of even spontaneous cures. Indeed, at the present time these feeble accessaries are no longer esteemed, and the new processes are resorted to as early as possible. Some persons have proceeded so far (but improperly, according to my opinion, particularly in important cases) as even to neglect all precautions in regard to regimen or general therapeutics. One or two bleedings, if the subject is of a robust or sanguine temperament, a diminution more or less considerable in the quantity of aliments, bitter and diluting drinks, anodynes, warm bathing, antispasmodics if there is agitation or great irritability, some preparation of digitalis to diminish the force of the impulse of the heart, a mild purgative when the digestive organs are clogged, and leeches if any local inflamation is developed, will never be omitted by any one who knows how to combine the principles of sound therapeutics with those of enlightened surgery.

§ 1. *Old Method.*

Apparatus.—According to the ancient method, the necessary apparatus was composed of a convex, a straight, and a probe-pointed bistoury, a female sound, some buttoned stylets, a spatula, needles of different forms, ligatures, a tourniquet or a *garot*, agaric, lint, bandages, sponges, scissors, &c. The skin which covers the aneurism and the parts about should be carefully shaved.

Position of the Patient and of the Assistants.—The patient being placed upon a bed or table conveniently situated, an assistant is charged with the duty of compressing the artery between the tumor and heart, with his fingers, a rolled bandage, the *garot* of Morel, the tourniquet of Petit, or some other instrument of the kind; a second assistant holds the sound limb, or faces the operator; a third presents or receives the instruments according as they are required or become unnecessary; a fourth and a fifth are sometimes of use in holding the head or other parts of the body, from the movements of which any danger might be apprehended.

Operation.—The passage of the artery being accurately known, the surgeon proceeds to divide with the convex bistoury, first the skin and the adipose stratum, and then at a second stroke the entire thickness of the cyst, beginning a little above and finishing by about an inch below. After having removed the coagula, and sponged and cleansed the botton of the wound, he then searches for the opening of the vessel, relaxing for a moment the compression, if necessary, in order more surely to arrive at it; introduces by this opening a buttoned stylet, the female or the grooved sound; raises the superior extremity of the artery; assures himself anew that it is really the artery which he has before his eyes; isolates it from the vein, the nerves, and the other tissues which he designs to avoid; passes the thread under it so as to embrace the sound at the

same time; seizes the two principal ends of this thread, which he draws towards himself with one hand whilst he applies the fore-finger of the other upon the raised trunk to feel the pulsations, to make himself sure that the artery has been well taken up and that the ligature which has just been passed around it will really efface its calibre; there is nothing more to be done then, but to tie the ligature with a simple knot while an assistant withdraws the sound, to fix this first knot by a second, and to cut one of the ends of the thread very close to the artery. The inferior extremity of the vessel is subjected to the same operation. The bottom of the wound is then filled with agaric, or better with pellets of soft lint, which are covered with large pledgets smeared with cerate; over these are applied compresses, and all are confined by a simple bandage which completes the dressing.

§ 2. *Method of Anel.*

When we operate without opening the sac, we may omit some precautions which are necessary in operating by the old method. The position of the patient, and of the assistants, is not materially different; but the compression of the artery above the tumor has no longer any particular object, and is nothing more than a matter of prudence. The point upon which it is expedient to apply the ligature, not being determined by the presence of the aneurism, demands some further attention on the part of the surgeon.

Point of Election.—In spontaneous aneurisms the incision should be made as far as possible from the tumor, because the nearer you approach it the more reason is there to apprehend coming in contact with a diseased portion of the vascular tunics. A contrary rule is to be observed in cases of traumatic aneurism, because while you are sure in placing the thread very low of finding the artery as healthy as any where else, you have the additional advantage of leaving untouched collateral branches more or less important. If in any case the operation should threaten to be much more difficult near the aneurism (unless there should be a voluminous supplementary branch to sacrifice), you would proceed to search for the vessel in that region where it would be more easy and less dangerous to expose it. The farther from the cyst you operate the less you are likely to determine rupture, suppuration, or inflammation. But we should not, in endeavoring to avoid one extreme fall into another; that is, to carry the thread immediately beneath any great secondary arterial branch. In fact the consequences of such an operation rarely fail to be troublesome; not, as it has been too often repeated, because the coagula, of which Jones has said so much, cannot be formed, but because the blood, finding a free and very large passage immediately above the bandage, does not permit the arterial parietes to approximate and form mutual adhesions. As it is necessary to reach, by the nearest possible way, the artery which is to be tied, the operator should first of all be perfectly acquainted with its course. This knowledge is acquired by calling to mind the relations of the muscular elevations, and of the furrows which separate them, as well as by the assistance of the arbitrary lines invented by M. Richerand, which are drawn between certain osseous projections.

Incision.—Whatever may be the decision on this point, the surgeon, placing himself on the same side with the aneurism, begins the operation by stretching the integuments, either transversely by means of the thumb, the fore-finger, and the cubital border of the hand, or by applying the extremities of all the fingers over the passage of the vessel in a line parallel to its direction, as is advised by M. Lisfranc. The incision is then made through the skin to

the length of from two to four inches. This incision should be made with a bistoury convex on the edge, rather than with a straight bistoury; and it is better to make it a little too long than too short. But in the greater number of cases, whenever it is not necessary to penetrate deeply, it is enough to make an incision of two or three inches. Most commonly it is made in the direction of the artery, but sometimes in that of the fleshy fibres; in such a case it may cross the vessel more or less obliquely. Care should be taken to avoid cutting too deeply at the first stroke: it is much better to repeat it a second time in order to get through the skin, than to come unawares upon the artery. After the integuments the aponeurosis is encountered, which is to be divided in the same manner, if the artery still remains at some depth. If not, or if the operator is not very sure of his hand, he passes a grooved director under the artery, to serve as a guide to the bistoury. The other lamellæ should be successively divided, with the same precautions and to the same extent. Having arrived at the lash of vascular and nervous cords, the surgeon should first open the common sheath. The director is here of the greatest importance. It is carefully entered either from the upper towards the lower part of this sheath, or from the lower to the upper, taking the precaution to raise it alone, and not to permit any of the parts which it may be dangerous to wound to slide between it and the instrument. In order then to isolate the artery, a grooved director is again used, which should be of steel (rather than of silver or of gold), slightly flexible, somewhat conical, without a *cul-de-sac*, and less obtuse than the ordinary probe. It is held in the manner of a pen, and the extremity is inserted between the vein and the artery. Then, by light movements to and fro, sustained, however, by a permanent though moderate pressure, the two vessels are separated to the extent of several lines. In the same degree that this separation takes place the operator reverses the position of the sound, in order that its beak (or nib), inclined by degrees as it passes under the posterior surface of the vessel, may present itself on the opposite side; at this point the fore and middle finger of the other hand remove the nervous trunks, or push backwards and to the outer side all the parts which it may be designed to avoid. This same director, before being withdrawn, should still perform another duty, that of serving as a guide, as it is, to the passage of the ligature; whether this is effected with a simple silver probe with an eye at one end, such as is used by M. Dupuytren, Richerand, and nearly all the French surgeons, or whether it be thought preferable to use for deep ligature the curved needle held with the pincers (described in the work of Dr. Dorsey), or the needle of J. L. Petit, that of Deschamps, &c., Desault conceived the idea of using, where it was necessary to operate at the bottom of a deep and narrow cavity, a spring-needle very much like the probe of Bellocque, which has been modified in England by Messrs. Ramsden, Earle, and Brenner. Sir A. Cooper in these difficult cases uses a steel wire, supported by a handle curved at its free extremity, and terminated by a knob, in the thickness of which is an opening destined to receive the thread. Scarpa much extols a small spatula of pure silver, very thin and flexible, which can adapt itself to the form of every part which it may be required to embrace. But the grooved director, such as I have already described, should rarely prove insufficient in the hands of a skillful surgeon. It possesses above all the special instruments, and the numerous needles which have been so carefully described by M. Holtz, in his Treatise on Arterial Ligatures (published at Berlin in 1827), the inestimable advantage of being able to isolate the artery with the greatest precision, and almost without laceration of the adjacent tissues. When it has once arrived

on the other side of the vessel, I cannot see how it should be impossible to slide the head of a flexible probe along its groove, and by this means to pass the ligature. An eye might even be placed near its point, so that it might pass the ligature at the same time that it separates and isolates the circumference of the artery. For the rest, every practitioner may understand the mechanism of these instruments, and can easily decide which should be preferred to the others. It is not only useless, but even dangerous to endeavor, as Scarpa advises, to raise and separate the vessel from the neighboring parts, with the fingers. By this method the tissues are lacerated, and a contused wound is formed, which must almost necessarily suppurate, while it is of the greatest consequence that it should be as clean and as regular as possible. Those who recommend to cut with the bistoury in a horizontal position all the cellular lamellæ which cover the artery, render themselves liable, notwithstanding the most minute precautions, to wound it, or at least, in the most successful cases, to prolong the operation.

The sound obviates these difficulties, permits the operator to act with more safety and promptitude, allows him to place the ligature around the organ in some sort, without displacing it or deranging its natural relations, and to expose it to the slightest possible extent.

The ligature should be sufficiently tight to arrest completely the passage of the blood, not only at the moment of the operation, but afterwards, which cannot be done when it includes with the artery any muscular, tendinous, or aponeurotic fibres, or even a shred of cellular tissue, because these parts of course soften and relax the ligature, and soon render it almost inefficient. In order to attain this end it is necessary to avoid passing the extremities of the thread twice, one within the other, and forming what is generally called the *surgeon's knot*. Under this knot, in spite of the most powerful constriction, the centre of the circle sometimes remains open and permeable. This happened to Chopart when, among the first in France, he attempted, in 1781, the ligature of the popliteal artery. Several ligatures were successively applied without being able entirely to suspend the circulation in the limb. Amputation was performed before the patient was removed from the table, and upon examination of the parts it was discovered that not one of the ligatures had entirely effaced the calibre of the vessel. Two simple knots are then to be preferred. If the ligature is of an animal material, the two ends are cut off so as to enclose the remainder in the wound; if otherwise, one extremity is left to hang outside. If, after having laid the artery bare, the operator perceives that it is diseased, that the parietes are yellow, fragile, or encrusted with calcareous plates, it might then be prudent to flatten it, as advised by Scarpa, instead of tying as in other cases. Nevertheless, Messrs. A. Cooper, Lawrence, and Briot have had no cause to repent having followed a different practice, and ventured to place a simple ligature about arteries obliterated, fragile, or entirely morbid. In such cases the strips used by Dr. Jameson may be of great service, unless there be some chance of deriving advantage from making a new incision, and practising the operation higher up.

Dressing.—The wound after being cleansed and freed from all foreign bodies with which it may be connected, should be immediately closed. Nothing is more to be feared than suppuration succeeding the ligature of arteries. Immediate reunion, on the other hand, in almost every instance ensures success; but it should be promoted from the bottom of the wound towards the edges, and not from the skin in the direction of the deeper parts, as the points of suture used by some surgeons tend to favor its occurrence. Consequently the operator should confine himself to bringing the lips exactly

together, by the aid of gradual compresses of strips of plaster, and of position. Then, after wrapping a small piece of fine linen round the exterior portion of thread, it is turned towards the most dependent angle of the incision, or to that which is nearer to the knot, or it is brought directly out by the shortest way between two strips of plaster. A compress smeared with cerate and pierced with holes, is applied above, or sometimes small bats of lint are used instead. With these precautions, there is then no hindrance after the first dressing to the removal of the different parts of the apparatus. A pledget of substantial lint, or one or two oblong or square compresses, cover these objects, and the dressing is terminated, according to the method of Kiesleyre, by a few turns of the bandage to secure the whole.

Subsequent Treatment.—The patient being returned to his bed, is there placed in such a situation that all the muscles of the part upon which the operation has been performed may be in a state of relaxation. The member, supported by cushions, should, according to some, be surrounded by warm aromatic bladders, or bags filled with ashes, sand, or bran, at the temperature of about thirty degrees. By others it is merely surrounded with soft and pliant pillows, suitably warmed; some even neglect all special precaution, and make no addition to the ordinary bed clothes unless the sensation of cold should become very considerable. This latter practice is the one which is recommended by reason. For either the circulation is re-established in the parts where it has been for a time arrested by the operation, and the temperature is of itself sufficiently elevated, or it is not re-established, in which case, artificial warmth has no effect but to hasten the development of gangrene. For the rest the operator proceeds as after all grave operations. Low diet, repose, the most perfect quiet, demulcent drinks, acidulous, slightly anodyne, or antispasmodic, are imperiously required. General blood-letting may also become necessary, in order to prevent or to relieve congestion of the viscera. It is most commonly useful to give the patient by spoonsful, during the first twenty-four hours, a potion, into which enter some gently aromatic liquid, some of the tincture or extract of opium, and sometimes a small quantity of ether or of Hoffman's cordial, in order to calm the state of nervous irritation or agitation into which the patients are frequently thrown. In such cases tepid linden-water is the most appropriate drink.

The first dressing should be made, at the soonest, on the third or fourth day—the most exact precautions should be taken to avoid giving the least motion to the member, exercising the slightest traction upon the ligatures, or disturbing in the smallest degree, in raising the portions of the dressing, the apposition of the lips of the wound, particularly when an immediate reunion has been attempted.

The same care is necessary in all the subsequent dressings until the coming away of the ligatures, which happens on the tenth, twentieth, or thirtieth day, and which can be hastened by very gently pulling at the threads, if they are slow in coming away, as soon as the obliteration of the artery appears to be complete. When the time of reaction is past, and the first symptoms have subsided, when the limb has recovered its natural temperature and sensibility, the severity of the regimen is gradually relaxed, and the patient is to be considered in this respect as convalescent. Yet, even after the complete cicatrization of the wound, he should for a considerable time indulge only in gentle and very limited movements, unless he would expose himself to death by consecutive hemorrhage from the re-opening of the wound, as it happened in one case cited by Beclard.

§ 3. *Results of the Operation.*

The operation for aneurism is sometimes followed by accidents or phenomena which require particular attention.

1st. The limb, as we have said before, becomes more or less cold during the first twenty-four hours. It then returns by degrees to its habitual temperature; sometimes, however, the coldness is succeeded by too much heat, which produces an irritation high enough to occasion gangrene. Vacca, and some other modern practitioners, have quoted examples of this description. The member should then be wrapped in flannel soaked in some emollient liquid, or covered with cataplasms of the same nature. Perhaps it would be as well to apply, according to the advice of M. Begin, leeches to the points which are most painful and particularly threaten to become inflamed. Several reasons also lead me to believe, that in this case a rolled bandage, moderately tight, would succeed more easily than any other means in relieving this state. Cold water too would be a resource worthy of trial.

2d. Gangrene, which is too often a consequence of the ligature of arteries, is not always preceded by this excess of heat. It more frequently depends upon the circumstance that the circulation is not re-established. The inferior part of the limb then remains cold and insensible, changes color, becomes the seat of *phlyctenæ*, and soon develops all the other symptoms of mortification. If the gangrene is not very extensive, or seems inclined to limit itself, the surgeon proceeds in the same manner as when it is produced from any other cause—he waits until the sloughs are detached, and the ulcers which result from them are cicatrized; but if it involve the whole thickness of the limb, nothing but amputation can then save the life of the patient.

3d. The sudden interruption of the course of the blood in a voluminous artery, sometimes occasions such a derangement of the general circulation as results in a high fever, signs of plethora and of congestion, or a great tendency in some of the principal organs to become seriously inflamed. Under these circumstances the antiphlogistic regimen should be enforced in all its rigor. Recourse should be had to bleeding, whether general or local, and even repeated as often as the strength of the patient or the acuteness of the disease may seem to demand.

4th. In other cases, certain *nervous symptoms* present themselves, and become troublesome. The pulse continues irregular, small, and quick; delirium supervenes; convulsive movements take place, and most of the signs of the ataxic fever are developed. Antispasmodics generally, but opiates, above all, are the remedies which are recognized as best in cases of this description. It would appear, that in a case treated by M. Gama, at Val-de-Grace, he found himself forced to administer laudanum in very large doses, in order to relieve this state, and that the delirium with which patients are attacked, bears some analogy to the "*delirium tremens*" to which drunkards are frequently subject.

5th. Ordinarily the tumor subsides or at least is diminished, and ceases to beat, immediately after the application of the ligature. At a later period it becomes hard, and contracts; the blood which it contains becomes concrete and is gradually absorbed; and the whole tumor, after a certain length of time, finally disappears, or only forms a small tumor, a mere kernel, hard, movable, and free from pain. Instead of these phenomena, others sometimes super-

vene. The pulsations which had ceased for a time, *reappear* at the end of several hours, or of several days; the tumor resumes its original size, and the operation appears to have had no influence whatever upon the disease. This takes place sometimes because the superior collateral branches open either directly into the tumor or between the tumor and the ligature, and thus introduce the blood in too great abundance; and sometimes because the fluid returns into the cyst through the inferior part of the artery. For the rest it is an accident less important than it was at first considered. Observation has demonstrated, that in a majority of cases the system will finally *prevail.* Whenever topical refrigerants, with the due application of the rolled bandage, or any kind of compression continued for some weeks, produce no advantageous change, it is necessary then to see whether it would not be more safe, if possible, to apply a new ligature close to the tumor, either above or below, or else to operate according to the ancient method.

6th. Instead of subsiding, hardening, or finally resolving itself, the aneurismal sac sometimes becomes hot and even inflamed, and tends to form an abscess. If cold topical applications, astringents, or compression, do not produce the effect we desire from them, then leeches and emollient cataplasms should be promptly substituted. But if suppuration should occur, manifested by decided fluctuation, it would be necessary to treat the aneurism as a simple abscess, to open it largely with the bistoury without too much delay, to empty it of the detritus which it contains, and to dress it then like any other suppurating wound.

7th. *Immediate reunion is not always effected,* although every thing may have been done to attain that end. Pus sometimes stagnates at the bottom of the wound, extends itself widely, and separates the tissues; and the muscular sheath, and that of the artery, becoming inflamed, soon suppurate in their turn. The patient is then in the greatest danger. The surgeon is then obliged, in order to resist these troublesome symptoms as soon as they are perceived, to divide freely the skin and all the layers which hinder the free issue of pus or other effused fluid, to lay open the wound to the bottom and through its whole extent, and to give up entirely the hope of effecting reunion by the first intention. When, in spite of all his efforts the surgeon perceives that suppuration is fairly established and spreading, and continuing long enough to enfeeble the whole organic system, or to give rise to fears of adynamia or of exhaustion, he must then endeavor to retard its progress by general remedies, to sustain the strength of the patient, to administer the extract, syrup, decoction, or other preparation of *Kina,* a little good wine, light but substantial aliments, &c., and occupy himself at the same time in modifying the ulcer by topical agents or appropriate incisions.

8th. The accident which has most occupied the attention of practitioners as a consequence of ligature of arteries, is that of "hemorrhage," though happily the degree of improvement to which the operative methods have arrived, renders it at present but of rare occurrence. It is most frequently observed, when in operating on a trunk in the vicinity of the heart, it has proved impossible to avoid placing the ligature very near a great collateral artery; when the tape has been badly applied, when it is displaced, when it has not been drawn sufficiently tight, when it has been fixed upon a diseased part of the vessel, or when this by any cause whatever is morbidly *affected* either above, or even in certain cases below the ligature. The hemorrhage again may be ascribed to the rupture of the sac, and may manifest itself in the first few days, or may delay its appearance for a long time after the operation; may depend upon the state of irritation in the wound, and may, in

some cases, be nothing more than a simple exhalation. The compression of the artery on the side towards the heart, compresses, lint steeped in cold water, or impregnated with the powder of Bonafoux, or with the liquid of Binelly, Talrrich, or Halmagrand, or with any other hemostatic substance, and applied to the part from whence the blood appears to emanate, are the first means to be put in use. When these are not sufficient for the purpose, you are then compelled to remove the dressings and all the effused blood, to tampon the sac, and have recourse to mediate compression. If these last means should prove insufficient, nothing is to be done but to choose whether to search for the two extremities of the artery at the bottom of the wound, and to tie them anew, or to apply the ligature at a higher point upon the limb. But happily we can more frequently dispense with this resort, and suppress the hemorrhage without a renewal of the operation.

Art. 8.—*Of the Suture.*

About the middle of last century, Lambert, an English surgeon, thought he could cure wounds in the arteries by means of a twisted suture. Observing that after bleeding, veterinary surgeons generally close the vein with a needle, he conceived the idea that this method, being applied to the arteries of the human subject, would be productive of the same results; several experiments confirmed him in this opinion, and his efforts in this were crowned with complete success in the case of a patient affected with a traumatic aneurism in the arm, whom he caused to be examined by the members of a medical society in London. Suture, it must be observed, appeared important in the eyes of Lambert, because he thought it would permit the conservation of the calibre of the artery; but Asmann having proved that he was mistaken on this point, and that the suture never succeeded but by obliterating the vessel, his proposition was soon forgotten, and has never since been revived.

Art. 9.—*Torsion, Bruising.*

Torsion, which is sufficient to arrest the progress of traumatic hemorrhage whenever the open extremity of the vessel can be isolated and conveniently seized, appears, from the experiments of M. Thierry, to be also capable of curing aneurisms. After having publicly advanced this idea at a *concours*, where he contended for the place of surgeon to the central bureau of hospitals, in the spring of 1829, M. Thierry made a certain number of experiments on the carotid arteries of horses. This process consisted in raising the artery with the needle of Deschamps, which he then made use of as a garot, in order to twist it always in the same direction a number of turns in proportion to its size or calibre: that is to say, four turns for a small artery, six, for one of middle size, and eight or ten for the more voluminous trunks. This practice has always effected the complete obliteration of the vascular canal, so as to permit immediate reunion, and to leave no foreign body remaining at the bottom of the wound; I do not think, however, that this new method should be generally adopted. In order to carry it into execution, it requires that the artery should be isolated to a considerable extent, and the reduction of length which it must undergo cannot but endanger the success of the operation. It would appear almost impossible to avoid stretching the veins, nerves, and other adjacent parts, even if we proceed in the manner of Mr. Lieber, who has equally interested himself in this subject. And afterwards, it is by no means

certain that the twisted organ does not present, in case of mortification, a foreign body more injurious than a simple ligature.

Others have thought that, after exposing the artery it would suffice to seize it with two pincers with flat blades, to twist it laterally so as to bruise the internal and middle coats, to crowd up the broken coats acting through the cellular coat, and to close the wound immediately in order to arrive at the same result. M. Carron du Villards says, that he made several experiments on this point with M. Maunoir, and that they were generally successful. These experiments were suggested to me in 1820, says he, by Professor Maunoir, sen., who at that time spoke to me of an instrument for breaking the internal tunic of the arteries without having recourse to the ligature. This instrument consists of a forceps similar to those of M. Amussat, for the torsion of the vessels, but has no teeth, and its free extremity is formed by two little ridges like grains of barley, which meeting, when closed, crush the artery and break the inner coats without affecting the outer. With the instrument of Maunoir, the closure of the arterial canal is almost always secured: but care should be taken to bruise it in several places; for if, as recommended by Jones, it is broken in only a single point, the effusion of the plastic lymph, which is designed to dam the current of the blood, is not sure to be determined. And we see that when a large artery is to be acted upon, if we breathe only one-third of its canal, or apply only two strokes of the pincers, as if to remove a lozenge of its tube, an aneurismal tumor is almost always in a short time the result. I had the honor to exhibit a tumor thus produced, to M. Pacoud, surgeon in chief of the Hotel Dieu, at Bourg who had favored me with the privilege of the amphitheatre of that hospital for the prosecution of a series of experiments upon animals.

The attempts of M. Carron have been since repeated by M. Amussat with full success; but with this surgeon the rolling up of the broken tunics is the principal point of the operation, and this is the characteristic of his process. It is to be feared that we may be deceived in signalising this latter modification as a benefit. The membranes thus turned up, will no doubt sometimes close the artery; but besides the fact that such an event does not *always* take place, I see the disadvantage of being obliged to expose the vessel to a great extent, to isolate it from the vein and the nerves completely around, and that to a great length, the same as in the process of M. Thierry—circumstances calculated to prevent immediate reunion, and to render the operation more tedious, more painful, and less sure, than the application of the actual ligature.

Acupuncture.

Some years since, whilst I was endeavoring on a certain occasion to separate the femoral artery of a dog from its corresponding vein, and was just pushing it to one side with a pin, some person entered and obliged me at the moment to suspend my operation. A motion of the animal caused the pin to sink through the artery, and it was lost in the thickness of the limb. It remained there until the fifth day. On careful examination of the parts, I was fully convinced that the obliteration of the vessel had been the consequence of this puncture. Such an effect struck me with some surprise, and appeared at first quite extraordinary. But I soon succeeded in explaining it in a satisfactory manner. If it is actually true that it is sufficient to retain the ligature for an hour or two on large arteries, in order to produce the obliteration, as we are told by Jones, Hutchinson, Travers, and others, it should then be possible to

attain the same end by occasioning, on a given point of these canals, any morbid process whatever, which shall be capable of interrupting the course of the fluids, and thus producing coagulation. Impressed with the idea that the contractions of the heart have less influence on the motion of the blood than has been generally imagined, I soon conceived how a foreign body, however small, kept across the vascular canal, or causing any elevation upon its interior surface, should be capable of producing the same effect as the ligature. So if an osseous or calcareous lamella, free at one of its edges, and adherent at the other, turns itself and juts into the artery where it was first developed, there is every reason to believe that it may become the centre, the nucleus, or the cause of a fibrinous concretion, capable of deadening, in a greater or less degree, the impulse of the blood, and of finally occasioning the obliteration of the vessel. The observations published by Mr. Turner, those which have been communicated to me by Mr. Carswell, and some others of my own, put this fact beyond doubt. What I have advanced in regard to an osseous spiculum, is evidently applicable to every species of prominences, asperities, or inequalities, which in any way diminish the normal regularity of the conduit through which the blood should circulate.

I am aware that this reasoning is liable to attack on more sides than one; so I give it for what it is worth, without attaching to it too much importance. But I resolved to submit it to some trials, in order to see if it would be possible for me to produce the same results, at will, which I had at first obtained by chance.

In the month of June of last year, I made some experiments with this view. An acupuncture needle, an inch and a half in length, was passed through the artery in the thigh of a dog, without previous dissection; I then placed two others on the opposite side, in order to see what difference of effect might be the result. In examining the parts on the fourth day, I found my first needle on the external third of the femoral artery, which was only one half closed; of the last two, one was found immediately outside of the vessel, which was obliterated by a solid clot of blood, about an inch in length, in the middle of which the second needle was discovered firmly fixed.

I renewed these experiments in the month of November following: then in the month of February, 1830. They were again repeated in April last, by M. Nivert, then the preparator of my course of operations, and now doctor of medicine at Azai le Rideau. I have more recently subjected them to other proofs at the hospital of La Pitie, and always with the same effect. In order to be more certain of not following upon the side of the artery, I have always, in these latter experiments, taken the precaution to expose it; sometimes I have only used a single needle, at others I have operated with two, and even three, according to the size of the vessel. Whenever a foreign body had been able to retain its place for at least four days, a small clot of blood has formed itself in the punctured part, and the obliteration of the vascular canal has resulted. The aorta under this treatment, however, experienced no change; but as the needles had only remained in position for a little more than twenty hours, I do not think it just to draw any positive conclusion from this circumstance.

It is proper besides to say, that up to the present time my experiments have been made upon dogs of inferior size, and that the femoral is the most voluminous artery I have yet pierced. It is sufficient to say that before drawing any practical inferences from these experiments, or applying them to the human subject, they should be repeated and varied upon animals of a larger size

than the dog. I should even add, that according to the observation of M. Gonzales, my experiments, upon being repeated by M. Amussat, have not produced results equally conclusive.

A single pin or needle has appeared to me sufficient for arteries which do not exceed in size the barrel of a quill; two or three for those one-half larger, and there would be no objection to the employment of four, or even of five, for the greater arteries. When many are brought into operation, it is necessary to place them at from four to six lines apart, in zig-zag position rather than in straight line.

If similar results could be hoped for on the human subject, the immense advantages which would be gained are obvious at a glance. Thus, instead of the hazard of wounding the nerves or the veins; instead of the dissection so minute, and often so dangerous, which is required for the ligature, torsion or bruising, it is sufficient to expose one of the faces of the tube to the slightest possible extent, without removing any part, in order to secure its obliteration. Perhaps even the most alarming aneurisms may be cured by this means, those of the thigh and of the popliteal space, among others, without dividing the skin; that is to say, by merely piercing the femoral artery in the bend of the groin with an ordinary pin, an acupuncture needle, any metallic wire whatever, or even piercing the aneurismal sac itself in different directions, with these foreign bodies; but I very much fear that it will fare with puncture as with seton, torsion, suture, and bruising; and that ligature will long continue to be preferred to these different means, notwithstanding the species of infatuation with which many practitioners, otherwise much to be commended, have been seized on this subject.

Art. 10.—*Changes occurring in the vessels of a limb after the operation for Aneurism.*

When an artery ceases to be permeable to the blood, after having been strangled with a ligature, alterations occur about the wound which are worthy particular attention. Among these alterations some are generally admitted, but the existence of others is not fully ascertained, or at least is still under discussion. The blood, obliged to take another route in order to arrive at the inferior part of the limb, crowds into the collateral branches, dilates them by degrees, speedily gives birth to anastomatic arches of such dimensions, that branches, before hardly visible, now acquire the size of a crow's-quill, and that other branches, somewhat larger, at last equal the third part or even the half of the principal trunk. The ease with which these supplementary courses are formed or developed, gives to the operation for aneurism such prompt and complete success, and causes the throbbings of the pulse which have been for a moment suspended, to reappear below the ligature. But if all are of the same opinion on this point, it is otherwise with the question whether new arteries are developed in order to re-establish the course of the blood after the interruption of the diseased trunk. Dr. Parry has been one of the first to speak of the regeneration of the vessels, which he admits as an incontestable fact.—He has seen, he says, the two ends of the carotid communicate with one another by many small vascular branches, a long time after having been tied or divided. It was with difficulty that he was at first believed, and his assertions did not command the attention to which he thought them entitled. At the same time or shortly after, according to the evidence of M. Foerster, a military surgeon, Mr. Ebel, arrived at nearly the same results, by experi-

ments repeated upon more than thirty animals. M. Sallemi, of Palermo, M. Zuber, of Vienna, and M. Seiler, have not been less successful. More recently M. Schœnsberg has renewed the experiments of the English physician on the carotid arteries of goats and bucks. He affirms that he has found upon these animals new branches of considerable volume, forming a net-work extremely complicated between the two ends of the divided tube. If the drawing presented by M. Foerster represents exactly what the surgeon of Copenhagen professes to have established, nothing can be more admirable than the efforts of the organization under such circumstances. It appears to me, however, that the operator sometimes deceives himself on the importance of this reproduction of the vessels, and that it is admitted oftener than it really occurs. To the facts reported by M. Schœnsberg, even allowing them full credit, may be opposed innumerable observations gathered from the human frame. If the new arteries reunited the two ends of that which had been divided, they would have been found upon the bodies of subjects who had died sooner or later after the operation for aneurism. Now, the finest injections, the most attentive and delicate dissections, have never been able to point out their existence. Instead of this complicated net-work, which has been spoken of by the authors whom I have quoted, there is nothing to be found but a flexible cellular cord, impermeable to fluids, which is insensibly confounded with the adjacent cellular tissue, and there are no new arterioles to re-establish the continuity of the intercepted trunk.

If I am not mistaken, the assertions of MM. Parry, Bell, Mayer, Foerster, Seiler, Zuber, and Schœnsberg, are founded upon a phenomenon not yet sufficiently observed, but which might perhaps explain the results at which these authors think they have arrived. The albuminous effusion which is created, and which concretes around the ligature in order to form the ring spoken of by M. Pecot, may become the seat (when it is fairly organized) of a vascular net-work of new formation, a thing often remarked in conformity with a general law in a great variety of accidental organic productions; these small vessels which present at first the appearance of tortuous capillaries, of simple hollow canals in the midst of an irregular substance, and in which the fluids and the blood circulate rather under the influence of chemical or physical laws than by the impulsion of the heart, continue as long as the *virole* remains isolated, and has not yet become a part of the surrounding tissues; but as this organic mass, abating little by little, gradually assumes the character and appearances of cellular tissue, properly so called, these small canals contract themselves in the same proportion, and finish in their turn by differing in no respect from the capillaries which run through the general lamellar system; whence it follows, that being susceptible of distention by matters of injection, they may have been observed, and even have presented a considerable volume during the first and second week after the operation, whilst at a more advanced period it would have been no longer possible to find them. They have then no part in the re-establishment of the circulation in the limb. A phenomenon of a similar description, but much more important, occurs at the spot where the capillary ramifications of the superior collaterals communicate with the capillaries of the inferior branches of the obliterated artery. According to the experience of MM. Kaltenbrunner, Wedmeyer, Dœlinger, Blainville, and others, the arteries discharge the blood with which they are filled into the irregular or parenchymatous cellular tissue, before it is taken up by the other vessels. In this organic course the fluids ooze rather than circulate. They act, so to speak, after the manner of water which escapes from a river, spreading itself by a thousand little channels through a plain of sand; at each

moment new conduits are cut, whilst the former ones disappear. The blood, no longer able to pass by its primitive central canal, creates for itself a number of passages, which organize themselves afterwards by degrees, in order to transfer it from the superior part into the inferior of the closed vessel; and it is without doubt to this effort that we must attribute the heat, the sensibility, and the redness, which are sometimes manifested under the skin, at the expiration of one, two, or three days after the operation for aneurism.

CHAPTER II.

OPERATIONS FOR THE PARTICULAR ANEURISMS.

SECTION I.

Operations for Diseases of the Arteries of the Inferior Extremity.

Exposed more than in any other part to external agents, being very numerous and for the most part large, the arteries of the inferior limbs are naturally subject, and more so than any others, to all the diseases of the arterial system. The surgeon is then frequently called to practise upon them very serious operations. But the main trunks, and their principal branches, are the only ones upon which these operations can be executed with advantage; so that we need only speak under this head of anterior and posterior tibial, peroneal, popliteal, femoral, circumflex, and iliac arteries.

A. Anterior Tibial in the Foot.

Art. 1.—*Anatomical Remarks.*

The anterior tibial emerges upon the foot from under the annular ligament of the tarsus, a little nearer to the internal than to the external malleolus; from thence it is carried obliquely inwards towards the first interosseal space of the metatarsus, which it penetrates from above downwards, to reach the sole of the foot, and forms there the plantar arch by anastomosis, with the external branch of the posterior tibial. It is separated from the bones and their ligaments by a simple layer of adipose cellular substance, and accompanied, sometimes on the inside and sometimes on the outside, by the internal branch of the deep dorsal nerve of the foot, and on the opposite side by its satellite vein. It is covered, proceeding from the deeper parts towards the skin: 1st, by a fine fibrous or fibro-cellular lamellæ, which separates it from the surrounding tendons; 2d, by a cellulo-adipose stratum, which is not always present; 3d, by the dorsal aponeurosis of the foot, which must be carefully preserved from being confounded with the subcutaneous stratum; 4th, by this subcutaneous lamellæ, which is thicker and fatter upon children, women, and others who are somewhat *embonpoint*, than upon men, or upon persons of a meagre habit, in which layer lie the superficial dorsal nerves and veins; 5th, lastly, by the skin the thickness of which is also very variable.

The first tendon of the common extensor of the toes is on the external side, that of the extensor of the great toe on the internal. The first fasciculus of the extensor brevis muscle crosses very obliquely from the outer to the inner side, and from behind forwards the anterior half of its length. Its tarsal and metatarsal branches are of too little importance to be described here, but it is not so with its anomalies. I have once met with it immediately under the skin, but more frequently it is wanting. A branch of the peroneal sometimes takes its place, at other times it is replaced by a strong branch of the posterior tibial. It is true that these varieties are calculated to embarrass many young surgeons who are practising upon the dead subject, but I do not see that this embarrassment can occur during life. In fact, if the vessel does not exist, there is no lesion which can render the search necessary. If it is given off by the posterior arteries of the leg, its dilatation towards one of the borders of the foot will not admit the idea of seizing it in its customary place, supposing that there is occasion to operate upon it in consequence of a wound.

Art. 2.—Surgical Remarks.

M. Boyer asks, if aneurism of this artery in the foot has ever been observed. Pelletan, Scarpa, Richerand, and Dupuytren, also, appear never to have observed it; whence we may conclude that it is at least of rare occurrence. Guattani mentions having seen an example occasioned by the operation of blood-letting; and M. Roux also mentions two cases where the division of this artery was the cause of troublesome hemorrhage. M. Vidal has published in the *Clinique*, a similar observation made in the hospital Beaujon. It is evident that should such a thing occur, compression would frequently be sufficient; and that in operating according to the modern method, the artery should be tied in the leg and not in the foot; but as it may become necessary to obliterate the vessel before and behind the affected part in consequence of the presence of the plantar-arch, to operate, in short, according to the ancient method, the surgeon should know how to expose the anterior tibial in the foot.

Art. 3.—Manual.

The patient should be laid upon his back, with the leg slightly flexed and the foot moderately extended. An assistant takes hold of the limb, clasping it above the ancles. The surgeon, with a straight or convex bistoury, makes an incision through the skin of about two inches, in the direction of the oblique line which runs from the middle of the instep to the first interosseous space; divides the subcutaneous stratum, endeavoring to avoid the principal venous and nervous branches which it contains; arrives successively at the aponeurosis, at the space between the tendons of the first two toes, at the second fibrous stratum, and finally at the artery itself, which he separates from the veins, the nerve, and the cellular tissue, by means of the channeled sound. He then passes the thread and ties it, after being well assured that he has taken up nothing but the artery. Two diachylum straps bring together the lips of the wound, and the operation is finished.

B. Anterior Tibial in the Leg.

Art. 1.—*Anatomical Remarks.*

The anterior tibial artery arises from the popliteal, and after having penetrated nearly at right angles the superior part of the interosseous ligament, descends in the direction of an oblique line drawn from the middle of the space between the head of the fibula and the spine of the tibia, towards the middle of the instep, or to the point at which it passes under the annular ligament. As it is applied almost immediately upon the interosseous ligament in the upper two-thirds of its length, and afterwards on the external face and front of the tibia, it is naturally situated at a depth proportionate to the elevation of the point at which it is sought. The two veins which attend it, often communicate with one another in front of it by means of small transverse branches. The nerve of the same name crosses very obliquely its anterior face, in a direction downwards and inwards; sometimes, however, it remains outside as far as the instep. A pliant and not very abundant cellular tissue surrounds these different organs, and unites them without furnishing them a real sheath. The anterior tibial lies between the common extensor muscle and the anterior tibial above; between the anterior tibial and the extensor of the great toe; in the middle and between the extensor of the great toe and the common extensor in the lower part of its course, and seldom presents anomalies worthy of the attention of the surgeon. Neither are the branches which arise from it, with the exception of its recurrent branch, of any importance in actual practice.

I have seen it twice becoming superficial from the middle of the leg. In one of these cases it proceeded, as is usual, from the popliteal; in the other, instead of crossing the interosseous ligament, it turned the outside of the fibula, and followed the track of the musculo-cutaneous nerve. It is no doubt to one of these two variations that we should attribute the pulsations observed by Pelletan in the front of the leg of a patient, and which was near deceiving this able practitioner into the belief that an aneurism existed in the part. Fortunately it is enough simply to call to mind the possibility of such an anomaly, in order to comprehend, as well as to avoid the errors which it might occasion.

Art. 2.—*Surgical Remarks.*

Since it is sustained by the interosseous ligament behind the bones of the leg on the sides, and by muscles which are forcibly bound down in front by a firm aponeurosis, the anterior tibial artery should rarely become the seat of spontaneous aneurism. For my own part, I do not know of a single instance, unless the sanguineous tumor mentioned by Pelletan, which destroyed by erosion a large part of the superior extremity of the tibia, may be regarded as such. Traumatic aneurisms of this artery are, on the contrary, frequently remarked. They are sometimes circumscribed, but more frequently diffused, and are produced by puncturing or cutting instruments, by balls and all descriptions of projectiles, by osseous spicula in fractures, &c. J. L. Petit, Desault, Deschamps, Dupuytren, Pelletan, Boyer, Roux, and Cowan, cite observations of this disease, and prove that it may occur at any point in the length of the limb.

In a case of consecutive false aneurism of which he has spoken, Deschamps operated according to the old method. Mr. Guthrie exclusively adopts the

same in such cases, and strongly opposes those who operate in a different manner. If the blood continued to flow from the wound, if the accident was but of recent existence, if the opening of the artery appeared to be easily discovered, one might or even ought to follow the practice of these two authors; but in every other case the method of Anel is much to be preferred. It does not appear to me by any means necessary to place a second ligature beneath the tumor or wound, as some surgeons have advised, as a moderate pressure will fully supply its place. If, however, the disease should be seated in the superior third of the leg, it would be difficult to tie the artery above without touching the tumor, and of course to operate by any other than the old method. In that, and in every other case where there is much difficulty apprehended in operating on the leg, there still remains, as a final resource, the ligature of the popliteal or the femoral. M. Dupuytren was the first to use it successfully. In 1810, in operating upon a woman of sixty years of age, who had been brought to the Hotel Dieu, affected with a large diffused aneurism resulting from a compound fracture of the leg. M. Roux has derived the same advantage in a case of hemorrhage following amputation below the knee, and M. Delpech has obtained several similar successes. Mr. Guthrie, however, who professes to have seen this operation practised at the battle of Albufera, and of Salamanca, before our compatriots had even thought of it, strongly objects to this practice. In the case of a soldier operated upon in May, 1814, hemorrhage returned by the wound, amputation became necessary, and the patient died. The same thing occurred with a soldier wounded at Salamanca. According to his opinion, it is much better to open the tissues freely at the risk of dividing the muscles, but it appears to me that the English surgeon goes too far, although without being entirely wrong. Even allowing it true, as a general rule, that the operation may be more sure, according to Mr. Guthrie's suggestion, yet the practice of M. Somme, of Antwerp, has sufficiently proved that the advice of M. Dupuytren may be followed with advantage.

Art. 3.—*Manual.*

The patient being placed in the same position as in the operation on the lower part of the artery, should have the leg held with the toes somewhat turned inwards, and disposed in such a manner that the muscles of its anterior region may be extended or relaxed at will, by the assistant acting upon the foot. In order to reach the artery in the inferior third of the leg, an incision must be made through the skin, the subcutaneous stratum, and the aponeurosis, to the extent of about two inches on the above described lines; then, with the fore-finger or with the extremity of a grooved sound, the tendon of the extensor muscle of the great toe is separated from that of the anterior tibial muscle, by pushing it outwards, if the operation is performed high up, and on the contrary by forcing it inwards if quite low down. This being done, nothing remains but to isolate the artery from its venæ comites and its accompanying nerve in order to tie it, to bring together the lips of the wound, and to apply the appropriate bandage.

In its middle part, or in its two superior thirds, this artery can be exposed by several different means.

1st. *Process of M. Lisfranc.*—In the process attributed to M. Lisfranc, by Messrs. Coster and Taxil, the incision in the skin is made obliquely from below upwards, from the crest of the tibia toward the fibula, one or two inches from the horizontal line. After the aponeurosis has been cut across, the interstice which separates the anterior tibial from the extensors is sought for,

and as it is the first which is encountered on the outside of the tibia, it is easily discovered.

2d. *Ordinary Process.*—In the common process, the incision is made parallel with the direction and over the course of the artery, always taking as a guide the above-mentioned line, or the middle of the space which separates the fibula from the crest of the tibia, or the slight depression which naturally corresponds with the interval between the muscles to be separated; or lastly, the operator may simply carry the bistoury an inch to the outside of the anterior edge of the leg. The aponeurosis, as well as the skin, should be divided to the extent of three or four inches; a yellowish line points out the muscular interstice, upon which the fore-finger is placed to separate the muscles, and to descend perpendicularly upon the interosseous ligament. At the bottom of this interstice is found the vessel, which the operator endeavors to isolate or to take up. This, however, is the most difficult stage of the operation.

After having caused an assistant to flex the foot, and properly to separate the muscles, the best means of managing the artery, in my opinion, is to slide the grooved sound beneath it very obliquely downwards and towards the tibia, instead of carrying it transversely or from the anterior ridge towards the exterior border of the leg. In order to estimate the utility of this direction, it is sufficient to call to mind that the fibula is almost on the same plane, whilst the crest of the tibia is considerably above the level of the vessels. The needle of Deschamps might nevertheless be easily used, as well as any other kind of port ligature.

No one at the present day will be tempted to follow the example of Dr. Hey, in cutting out a portion of the fibula, to arrive more easily at the tibial artery; as this surgeon affirms that he has once done with success.

M. Lisfranc thinks that the oblique, rather than the parallel incision, displays more clearly the interstice which is to be our guide, and also the vascular tube itself. This decision is correct on the first point, but if I may believe the result of frequent experiments on the dead subject, it is not altogether the same upon the second. So that without entirely rejecting his method of operating, I am still induced to prefer that of the other surgeons, at least in ordinary cases, and in every instance where there are no special indications to fulfill.

C. Posterior Tibial.

Art. 1.—*Anatomical Remarks.*

The posterior tibial artery from its beginning, a little below the popliteus muscle, down to its division into the internal and external plantar arteries, follows exactly the direction of a line somewhat convex inwards, and extending from the middle of the beginning of the calf to a point half an inch behind the internal malleolus. It is generally accompanied by two veins of considerable size, which even sometimes form an actual net-work around it by frequent anastamoses. On its fibular side lies the posterior tibial nerve, which is rarely more than three or four lines from it. Resting in its whole extent upon the deep seated muscles, it is covered by the aponeurosis which lies between the two fleshy strata of this region, by muscles or cellular tissue, and some more fibrous lamellæ, then by the common integuments. But there are differences at some points in its length which it is important to note.

1st. *In the Calcanear Arch.*—The posterior tibial artery is applied against the fibrous sheath of the common extensor of the toes, at about three lines

from the posterior border of the malleolus; the nerve is behind, and the veins on the inside; a lamellous or adipose tissue envelopes it; the internal ligament of the tarsus, a species of fibrous lamina, continuous with the aponeurosis of the leg, covers and confines it, and confounds itself with the dense and filamentous tissue which separates the vessel from the skin.

2d. Between the malleolus and the calf it has receded somewhat from the internal edge of the tibia. The nerve lies rather on the outside than behind. The lamellæ which immediately surround it, are very pliant, and frequently loaded with fat. The deep-seated aponeurosis, which is here quite thin, keeps the vessel applied against the posterior tibial muscle, the long common flexor, and the long flexor of the great toe. On the outside of this layer is found the tissue which fills the sheath of the tendo Achilles, and then just within the skin, the common aponeurosis of the leg.

3d. In the calf of the leg the tibal artery is deeply seated, almost upon the same plane with the posterior face, and much nearer to the fibula than to the free side of the bone from which it derives its name. The aponeurosis which covers it, and touches it almost immediately, is striated, lustrous, and strengthened with very strong longitudinal fibres. Farther up it is concealed by the tibial portion of the soleus muscle, the inner head of the gastrocnemius, the superficial aponeurosis, and the subcutaneous stratum, in which are bedded the saphena vein and the corresponding nerve.

It is but seldom that the posterior tibial is wanting, but it may happen that it is very small, and that the peroneal takes its place in supplying the sole of the foot. It is more common to see it keeping the median line until it approaches the malleolus. The nerve is in such cases on its inner side. I observed it on one occasion to proceed side by side with the peroneal for two-thirds of its whole length, and then to enter the hollow above the heel at nearly an inch behind the malleolus.

Art. 2.—Surgical Remarks.

Like the anterior tibial, and for the same reasons, the posterior tibial artery is but rarely the seat of spontaneous aneurism, or even of false aneurism, whether diffuse or circumscribed. But Ruysch cites an instance of aneurism near the heel, which could have arisen from no other artery, and which was opened for an abscess. Dr. Dorsey has observed a varicoid dilatation of this artery accompanied by hypertrophia, in a case of varicose aneurism. Guattani likewise speaks of pulsatile tumors, which were evidently the result of some lesion in the posterior tibial: Wounds of this vessel, accompanied by hemorrhage or diffused aneurisms, have been observed of late, by Messrs. Scarpa, Hodgson, Marjolin, Dupuytren, Earle, and others.

The ancient method, according to M. Boyer, is the only one which should be applied to these affections; because, by the method of Anel the blood would certainly be returned from below, through the plantar arch and the anterior tibial artery. Others harboring the same fears, but unwilling to operate upon a diseased part, have proposed an intermediate method, that is, to place a ligature above and another below the aneurism, without touching the tumor. For my own part I cannot see the necessity for such a procedure. Supposing that the reflux of the blood should prove a hindrance to the cure, it appears to me, that in order to prevent it there needs only the application of accurate compression upon the passage of the anterior tibial artery in the foot, as practised by M. Marjolin, or even just below the wound, if its situation will permit. And when the seat of the disease is in the sole of the foot, and when com-

pression has not succeeded, it is plain that the ligature of the trunk of the tibial can be practised only according to the modern method. The only case where the ancient operation would be requisite, or at least preferable, is when the aneurism lies in the superior half of the leg, and here many will prefer the ligature of the popliteal, or the femoral itself. Traumatic diffused aneurisms are not subject to this rule, and should be treated as they have hitherto been by Boyer and Guthrie, that is by the method of Keisleyre.

Art. 3.—*Manual.*

At whatever point the posterior tibial artery is to be exposed, the leg should be flexed and laid on its external side. If compression is necessary, it should be applied in the thigh, or upon the body of the pubis.

1st. *Behind the Malleolus.*—The operator makes a slightly curved incision, concave anteriorly, beginning an inch above and ending an inch below, and passing at least three lines from the posterior edge of the malleolar projection. In operating upon the beginning of the calcanear furrow, it is necessary to proceed with much caution, to cut the tissues by laminæ, and to pass the grooved sound under the aponeurosis before dividing it with the bistoury, if we would avoid wounding the artery, which is here sometimes very superficial. An incision nearer to the malleolus would involve the risk of falling upon one of the fibro-synovial sheaths, which it contributes to form, and nothing can be more dangerous than such a mishap, on account of the inflammation which might result. Farther back the artery would be difficult to find, and the operation much more laborious. For the rest, after having isolated the vessel from the adjacent parts, it is immaterial whether it be raised with the sound from the inner or the outer side.

2d. *Below the Calf.*—In order to discover the posterior tibial between the malleolus and the calf, a straight incision is made, from two to three inches in length, at equal distances from the inner edge of the tibia and the tendo Achilles. The skin, the adipose stratum, and the superficial layer of the aponeurosis, having been divided, the next step is to denude with the sound the deep-seated aponeurosis. An incision is then made through that membrane of the same extent with that in the skin, the bistoury being carried only in the groove of a director. The operator will here be sure to meet with the artery, particularly if he has taken the precaution to cut the tissues perpendicularly, that is to say, by carrying the bistoury forwards and outwards, as if to strike the peroneal side of the tibia. It is necessary here to observe that if the incision of the integuments is commenced nearer to the bone than above directed, there will be only *one*, instead of *two* aponeurotic layers to traverse; but then, in falling upon the muscles at a great distance from the artery, there is a greater risk of error, than by the method previously directed.

3d. *On the Calf of the Leg.*—Mr. Guthrie upon one occasion proceeded to seek for the posterior tibial, by penetrating through the whole thickness of the calf. Gelee, in a similar case, made a counter incision, passed a ribbon between the muscular beds and tied it over the fore part of the limb, which he protected with compresses, having previously insinuated pieces of lint deeply into the wound between the muscles and the artery, for the purpose of directing upon the latter a sufficient compression. His patient recovered. But most authors recommend to penetrate by the inner side of the leg, and to detach and turn outward the corresponding portion of the *soleus* muscle and its aponeurosis, from the posterior face of the tibia. By this method, however, the

operator is exposed to the risk of denuding the bone, of being unable to penetrate to the artery without considerable difficulty, and of meeting so much opposition from the muscles, as to oblige him, after the operation, to divide their fibres crosswise upon the outer lip of the wound, as occurred to Mr. Bouchet, of Lyons. By proceeding in the following manner the inconveniences above-mentioned will be avoided.

The surgeon placing himself on the outside of the limb, makes an incision of about four inches in length in the direction of the inner edge of the tibia, and at a good finger's breadth from it, draws aside the saphena vein, divides the aponeurosis, and falls perpendicularly upon the fibres of the soleus muscle, which he incises, layer by layer, as if to gain the posterior face of the tibia, near its outer border; he soon exposes a fibrous bed, thick, white, and shining, into which the fleshy fibres are inserted—it is the deep aponeurosis, traversed by many vascular branches. The artery is immediately below it, enveloped by its veins and accompanied by the nerve, which may be distinguished by its roundness, its size, and its yellow color.

D. Peroneal Artery.

The peroneal artery rarely, except in its superior half, claims the assistance of the operative surgeon. Below it is too slender and deeply situated, to be susceptible of much relief when injured. In cases where aneurisms develop themselves upon any point of its course, of which the practice of the Hotel Dieu last winter offered an example, the best mode of procedure would perhaps be to tie the popliteal or the femoral, rather than the diseased trunk itself. But if some particular circumstances should render a contrary course of conduct necessary, the following seems to be the most eligible method to be pursued.

Operation.—As it would be necessary in the calf of the leg to seek the peroneal artery at the depth of several inches (whether the operator imitate the practice of Mr. Guthrie or follow the rules given for the posterior tibial) and as in the lower fourth of its course this vessel is not of any importance, it is only at the place where the *soleus muscle* separates itself from the gastrocnemius, that we should think of tying it. An incision three inches in length, parallel with the posterior edge of the fibula, directed toward the axis of the limb, comprehending the skin, the adipose stratum, the superficial aponeurosis, the external origin of the soleus muscle, and the deep aponeurosis, would serve to expose it and to isolate it in the substance, or on the posterior and internal face of the long flexor muscle of the great toe. Mr. Guthrie, who has declared himself an enemy to the method of Anel in traumatic aneurisms, in order to reach the peroneal artery, which had been wounded by a ball, preferred cutting vertically into the calf of the leg to the extent of seven inches, dividing crosswise the extreme edge of the wound, and afterwards encircling it with a mediate ligature, by means of a suture needle instead of attempting to discover the artery above. I am of opinion, that in such a case it would be better to follow the plan of Guthrie than to tie the trunk of the femoral.

For all these ligatures, M. Lisfranc recommends that the incision of the integuments should cross the direction of the artery at an angle of 35 degrees, instead of being parallel to it. "By this expedient," says he, "will be obtained greater facility in holding aside the lips of the incision, and an almost absolute impossibility of missing the artery." This modification may be adopted without doubt, and would perhaps be preferable in particular

instances; but it does not appear to have sufficient advantage over the ordinary practice to deserve a more particular recommendation.

E. Popliteal.

Art. 1.—*Anatomical Remarks.*

The ham, much noticed in surgery during the last century on account of its principal artery, is an excavation in the form of a lozenge, formed of two triangles, with a common base, and of which the larger part is placed above the condyles of the femur. Here the Sartorius, semitendinosus and semimembranosus muscles, together with the adductor magnus, form its internal, the biceps the external, and the femur the anterior wall. In the portion lying in the leg, the origins of the gastrocnemius and the condyles of the femur limit it upon the sides, while the posterior face of the articulation and of the popliteus muscle form its floor. Lastly, an *aponeurosis*, with transverse fibres, sometimes of considerable strength, continuous with those of the thigh and leg, closes this whole space from behind.

The popliteal artery traverses its length from above, inclining a little nearer to its inner edge (which conceals it in the upper part of the space) than to the outer edge, as far as the point, where it passes into the fossa between the condyles. In the femoral part of the space, the vein is strongly united to the artery behind, and to the outside; the internal branch of the sciatic nerve is still more superficial, and four or five lymphatic ganglions, with some cellular tissue and fat, surround the vessel and separate it from the aponeurosis. On the leg it is less deeply situated; the vein and the nerve are frequently found on the inside; at other times the former lies on the peroneal side, while the latter is on the tibial. Its fatty cellular tissue, and a little lower down, the origins of the gastrocnemius conceal it from behind while its anterior surface rests on the posterior ligament of the articulation and the popliteus muscle. It is well to add, that the external saphena vein ceases to be superficial when it enters this region, on the median line of which it is generally observed, and that it empties a little above the condyles into the popliteal vein.

Art. 2.—*Surgical and Historical Remarks.*

In no part is aneurism more common than in the ham. Spontaneous aneurism is that to which it is particularly subject. Traumatic aneurism is also of frequent occurrence, and varicose aneurism is sometimes met with. The great frequency of the first has much occupied the attention of surgeons. Some have attributed it to efforts at the extension of the leg upon the thigh. Scarpa, M. Delpech, and others, oppose this opinion, and maintain that aneurism which is not the immediate consequence of a direct wound, is always produced by a disease of the internal or middle tunic of the artery. M. Richerand thought to solve the problem in favor of the opinions of the former surgeons, by the following experiment. He took the lower extremity of a dead subject, which he briskly forced to its greatest possible extension by acting on its two extremities, whilst the knee, or middle and convex part, was supported on a solid body. Dissection afterwards showed the internal coats torn and bruised in several places. But Mr. Hodgson mentioned experiments which have been attended with opposite results, and the greater part of modern practitioners adopt the opinion of Scarpa. Has this question ever

been presented in its proper light? Would it not be possible to reconcile the two modes of viewing it? It is true, that whilst the artery is perfectly sound no extension of the leg appears capable of breaking its coats; but if its interior is incrusted with calcareous plates, or is the seat of ulceration; if one of the membranes has lost its flexibility and has become brittle, why reject the explanation of M. Richerand? It is laborious men—those who are always erect, jockeys for example—that most frequently present this malady.

The form of the popliteal aneurism, the effects that it produces, and all that concerns its development, find a very natural explanation in the anatomical disposition above described. Arrested by the bones in front, and by the aponeurosis in the rear, the tumor extends itself at first in length and breadth, and remains for a considerable time without external prominence. Thus confined, it presses upon the lymphatic ganglions, the vein and the nerves, and occasions swelling, infiltration, pain, numbness, and sometimes gangrene of the leg. The pressure which results from it may also determine the absorption of a part, or even the whole of the thickness of the bones, of which several examples are cited. Most frequently, however, the aponeurosis yields and becomes thinner, and the aneurism comes to project under the skin, without producing all these evils.

Anatomy teaches us, that the seat of the opening in the artery cannot be correctly ascertained by the point occupied by the external tumor. The resistance offered by the soft parts of the popliteal regions being less in the middle, than in any other part, it is evident that here the aneurismal cyst will always tend to project. If then the ulceration take place in the tibial angle of the space, the aneurism will nevertheless make its appearance above the condyles; and if on the contrary, it occur in the superior angle, it will be seen gradually to descend. This is a point which ought always to be kept in view in practice, at least in operating by the ancient method.

The anastamoses by which the arteries of the leg communicate with each other are so numerous and large, that the surgeon need not be under the slightest apprehensions with regard to the re-establishment of the circulation in that part of the member after the operation for aneurism, but in the hollow of the ham the operation is not attended with the same certainty. There the artery is alone, and the supplementary branches are very small. The older surgeons, persuaded that the obliteration of such a trunk would produce mortification of the parts which were nourished by it, had no other resource, after the use of compression and a weakening regimen, but the amputation of the thigh. Even J. L. Petit, and Pott, labored under these apprehensions. N. Guenaud vainly endeavored to remove them. If any more fortunate results were announced, it was said that they were produced by an irregular distribution of the arteries; no one durst believe that the blood could arrive at the leg after the ligature of its only arterial trunk; and it required the operations performed by Guattani, Pelletan, Desault, Hunter, &c., and above all, the researches of the laborious Scarpa, to give prevalence to the opinion opposed in the beginning of this century. At the present day, however, there no longer exists any uncertainty upon this point, and popliteal aneurism is now attacked with almost as much confidence as that of one of the tibial arteries.

Nevertheless, it would be wrong to dissemble that this operation is a very serious one, and ought not lightly to be attempted. In this, as in aneurisms of the superior third of the leg, I should prefer the old method, or even that of Brasdor.

The enfeebling regimen applied to aneurisms of the popliteal artery, is a resource too dangerous and uncertain to be seriously recommended. Cold

applications—ice or clay, used topically—so highly spoken of by M. Kalmski, have not been very successfully used, excepting by Messrs. Guerin and Dutrouilh, of Bordeaux. Mediate compression, either upon the tumor itself, above it, or over the whole limb, has been attended with results more advantageous. Guattani, Messrs. Boyer, Pelletan, Richerand, Ribes, Dupuytren, Viricel, &c., cite examples of cures obtained by these means. But eleven months of care and absolute rest were required for the recovery of the patient under the treatment of Eschard, besides, these cures are rare. M. Roux mentions a case where compression, directed successively upon different parts of the thigh, was followed by the most lamentable effects, and that without arresting the progress of the aneurism. Compression may, notwithstanding, be used upon young, feeble, or timid subjects, who have a great repugnance to an operation, remembering always that it should be combined with refrigerants and the treatment of Valsalva.

If the patient is unable to support it, and it aggravates instead of ameliorating the symptoms, it is easy to remove it and to have recourse to other methods. When the disease evinces a disposition to disappear spontaneously, it cannot be denied that compression will powerfully assist the salutary efforts of the system. In such cases, at least, it is likely to be attended with success. Sometimes the tumor has disappeared without surgical assistance. M. Trousseau relates the case of a countryman who was admitted into the hospital at Tours, with an aneurism in the ham. A consultation of the principal surgeons of the city took place, and the necessity of an operation was unanimously admitted. The next day, however, the pulsation in the tumor was found in a great measure to have subsided; three days afterwards it was not to be felt, and at the expiration of two months the patient found himself perfectly restored, without having undergone any operation whatever. M. Blizard and M. Salmade give each a similar example; and the records of the science contain several others not less remarkable.

As to the ligature, it would seem by a letter from Testa to Cotugno, that Keisleyre had used it many times before it was discussed in Italy. Lochman, another surgeon of Lorraine, also practised it successfully upon a patient at Florence, in 1752; and Burchall ventured to do the same at the Manchester Infirmary, in 1757. These facts, no doubt, were what awakened the attention of Mazotti and Guattani. In two operations performed by the former, he placed a second ligature below the perforation in the artery; and it was with this modification that the practice of Keisleyre was attempted for the first time amongst us by Pelletan, in 1780.

If requisite, the popliteal artery might be tied according to either of the three known methods. The old method has been very frequently resorted to in France, by Pelletan, Desault, Deschamps and Boyer, but presents so many difficulties that it has been very little practised during the last ten or fifteen years. It is rarely, also, that Anel's method, strictly taken, can be applied to aneurisms of the ham. Desault is the only one that has so used it; and his experience tends to prove that it is infinitely better to tie the femoral itself. Although the plan recommended by Brasdor has never yet been tried, I do not think proper in this place to pass it unnoticed. In fact, if the tumor has not too much deformed the part, is not too voluminous, occupies the femoral portion of the popliteal space, it appears probable that the ligature might sometimes be placed below the diseased part. Nevertheless, as the operation would thus become a little more difficult than if performed upon the thigh, without securing any very manifest advantage over either of the other methods, it is for experienced and enlightened surgeons to decide upon

the propriety of its adoption in certain cases. It is only then in aneurismal affections of the superior third of the leg, that ligature of the popliteal artery will be found advantageous; Anel's method is therefore the only one in which it can be practised. It need not after all be attended with much difficulty; perhaps it ought even to be preferred when the patient is of a spare habit, and when every thing indicates that the disease does not extend so far as the ham.

Art. 3.—Manual.

1. *Ordinary Process.*—The patient is laid prostrate, and the leg is moderately extended. To reach the artery in the lower part of the popliteal space, an incision is made through the skin and subcutaneous layer in the median line, parallel with the axis of the member and three or four inches in length; care being taken to push outwards the external saphena vein if it presents itself under the edge of the bistoury. The aponeurosis once divided, the cutting instrument becomes useless. The cellular tissue and the fat are then cautiously torn; the fibres of the gastrocnemius are pushed aside, and the vessel is separated from its vein or veins by means of a grooved director. *Above the Condyles* it is more easy to avoid the saphena. The incision should be longer, a little nearer to the inner than the outer side of the ham (at least high up), and to follow a slightly oblique direction, so as to come over the fossa between the condyles. Beneath the aponeurosis are the nerves; a little deeper the veins; and, quite at the bottom, the artery; which it is usually very difficult to separate from the vein, and which is always here more deeply situated than in its inferior half.

2. *Process of Messrs. Jobert and Ashmead.*—A new method, totally distinct from the preceding, has been invented by one of my fellow-students. Instead of making an incision upon the posterior surface of the popliteal region, M. Jobert recommends that the artery should be sought by penetrating in the depression that may be observed when the leg is half bent above the internal condyle of the femur, between the vastus internus and the inner border of the ham. By this method it appears to me that difficulties are created, which do not exist in the ordinary mode of procedure so long as the operator keeps in view the anatomical disposition of the parts. I do not think, therefore, that the modification of M. Jobert ought to be adopted, notwithstanding the more precise rules to which Mr. Ashmead (who believed himself to be the originator of this method) has since subjected it.

Results of the Operation.—Whatever may have been the means, method, or process, by which a cure has been occasioned, the efforts of the organization in re-establishing the circulation of the blood are always the same. The obliteration of the vessel extends to a certain distance above and below the wound or part compressed by the ligature; the branches which keep up the communication between the perforating arteries and the superior articular branches, together with some branches of the superficial femoral, and the inferior articular arteries, the gastrocnemial and the recurrent tibial, augment gradually in volume, and at last form a beautiful net-work round the articulation. The blood then passes easily from the thigh into the arterial canals of the leg. There is, in the Museum of the Faculty, an anatomical preparation taken from a patient cured a long time before by Sabatier. A drawing of a similar preparation may also be found in the first volume of the Clinique of Pelletan. Messrs. A. Cooper, Hodgson, Dupuytren, &c., have also observed the same; and I had an opportunity of assuring myself of its reality, on the body of the

first one upon whom the ligature had been applied at Paris for popliteal aneurism. It was in 1780 that this patient placed himself under the care of M. Pelletan. He was then thirty-two years old, and died at the age of eighty-four. The trunk of the popliteal artery was transformed into a fibro-cellular cord, quite slender and pliant, through almost its whole extent; the superior articular arteries, internal and external, the anostomica magna and a branch of the superficial muscular, furnished by the femoral, were of the size of large crow-quills, and formed large and irregular arches, upon the sides of the patella and the condyles, by communicating with the recurrent branch of the anterior tibial, the inferior articulars, &c. The limb was in good case, and did not differ in any respect from that of the opposite side.

F. Femoral.

Art. 1.—*Anatomical Remarks.*

The femoral artery extends from the crural arch to the beginning of the inferior third of the thigh, and follows a line somewhat spiral, descending from the middle of the fallopian ligament obliquely inwards to the space between the condyles of the femur, where the continued trunk is called the popliteal. The vein, lying on its internal and posterior side, is united to it by dense cellular tissue, which forms for both a sort of common sheath. The principal branch of the crural nerve, which at first lies upon its external side, inclines by degrees as it descends towards its anterior surface, and sometimes to its internal side; but farther down abandons it altogether, to pass between the muscles which form the side of the ham. Another nerve, not less voluminous, sometimes crosses its superior part, lying before it and the vein, as far as the middle of the thigh. A fibrous sheath, hollowed from the thickness of the deep layer of the fascia lata, envelopes the whole, and presents a disposition of parts which merits particular attention. The interior wall of this sheath gradually increases in thickness as it descends; for at the groin it may be easily torn with the sound, while below it often presents very distinct transverse fibres, a pearly appearance, and great resistance. At its lower extremity, it is continuous with the fibrous expansion, or more properly with the aponeurosis given off by the termination of the second rather than of the third adductor. The artery is next covered by the sartorious muscle, which crosses it very obliquely from the outer to the inner side, and conceals in reality only the two inferior thirds. In the superior part the artery is covered by the deep lymphatic ganglions, and by clusters of filamentous cellular tissue. It is only when the sartorius approaches the gracilis muscle to form the apex of the inguinal triangle, that its internal edge begins to separate the artery from the superficial layer of the aponeurosis of the thigh, which almost touches it in the bend of the groin. As we proceed towards the skin, after the sartorius muscle, comes the first lamina of the fascia lata, pierced in the upper part by one or more openings for the entry of the superficial veins into the deep femoral, then the subcutaneous stratum which contains the branches of the saphena vein, which latter is almost always situated within the line of direction of the artery.

Among the branches of the femoral, there is a certain number which ought not to be forgotten by the surgeon, viz. 1st. The *profunda*, which separates itself from the femoral about two inches below the ligament of Poupart, buries itself in a line with the lesser trochanter beneath the deep layer of the aponeurosis, and divides into the three perforant branches. 2dly. The circum-

flexes, which proceed sometimes from above, sometimes from beneath, and frequently from the profunda itself. 3dly. The superficial muscular, given off by the external circumflex and descending to the knee to form anastomoses with the branches of the popliteal. 4thly. The anastomica magna, which has its origin near the commencement of the popliteal, and proceeds towards the inner side of the leg along the superior surface of the third adductor.

Anomalies.—The secondary branches of the femoral are subject to numerous anomalies, but the trunk itself presents very few. Morgagni, who believed it to be often double, merely supposed it but never really observed it. Haller, the same. But Gooch cites three examples; Cassamayer mentions a fourth; and I have myself met with a fifth. In my own case the supernumerary artery was evidently only a continuation of the *profunda,* which, after having supplied the perforating arteries, preserved sufficient volume to enable it to descend below the knee. In a subject affected with aneurism, Mr. Charles Bell found the femoral artery divided into two trunks of equal size, which united to form the popliteal. Mr. J. Houston, conservator of the anatomical museum in Dublin, cites a similar fact. Messrs. Bronson and Cromwell, distinguished young physicians of America, pointed out to me in 1825, in the pavilion of the practical school, a different variety. Instead of remaining contiguous to the artery, the crural vein was, on the contrary, separate from its commencement, and did not rejoin it until its entry into the popliteal space, after having formed a long arch the convexity of which looked towards the internal edge of the thigh. I have once since met with a similar disposition.

Art. 2.—Historical and Surgical Remarks.

If spontaneous aneurism is more common than any other in the popliteal space it, is not so at the thigh; although even there it is not of very rare occurrence, particularly in the upper part where the artery, badly protected in front, is obliged to follow the different movements of the articulation. All its other parts may also be the seat of spontaneous anuerism, but the thigh is more particularly subject to traumatic aneurism. Diffused and circumscribed false aneurisms often occur there; nor is this part exempt from varicose aneurism as has been proved by the observations of M. Larrey, and by a case which was treated at the Hotel Dieu, in 1824, by M. Guersent, jun. In the lower part the sartorius muscle has a tendency to force the tumor forward; in the superior part it often pushes it inward; this, added to the thinness of the aponeurosis, rent the fallopian tube, and explains the remark which has been made by so many practitioners, viz: that in the groin the opening of the vessel almost always corresponds with the inferior third of the aneurismal bag. As they are not surrounded by solid parts, aneurisms of the femoral speedily enlarge; yet, as they comprise neither voluminous nerves nor important articulations, they are, other things equal, attended by fewer unpleasant symptoms than aneurisms of the popliteal artery.

Spontaneous Recovery.—Aneurisms of the thigh, notwithstanding the size of the artery which gives them birth, are not always fatal. M. A. Severin relates a case where the tumor was attacked by gangrene. After the fall of the eschars, the wound cicatrized by degrees; there was no hemorrhage, and the limb returned to its natural state. Lancisi saw an aneurism, which, though very voluminous, decreased by degrees, and finally disappeared under the influence of simple fomentations, tepid baths, and diluents. Guat-

tani saw, at Rome, in 1765, a similar case to that mentioned by M. A. Severin. Clarke, in 1784, witnessed another. Ford saw an aneurism of the thigh cured without other assistance than that afforded by spare diet and rest. Mr. Spalding, in 1808, after having opened and cleansed an enormous crural aneurism, was astonished to find the artery completely obliterated above and below the lesion, and not a drop of blood to issue from either end. Mr. Hodgson, in operating upon a dead subject, encountered an aneurismal bag in the inferior third of the thigh, the coagulum of which, extremely solid, had completely obliterated the artery as far as the origin of the *profunda*, in one direction, and to the commencement of the leg in the other. Finally, M. Marjolin, in his lectures before the faculty, makes mention of a man aged sixty, afflicted with an aneurism of the middle of the femoral, which transformed itself into an abscess, and disappeared after a long suppuration. Mr. Guthrie cites a similar example, which took place in the York hospital.

But these cases ought to be considered only as happy exceptions, on which it would be imprudent to count in practice.

The refrigerant method, antiphlogistics, regimen, and compression, have also produced favorable results. Hodgson adduces numerous examples. At Bordeaux, M. Teyran cured a femoral aneurism by bleeding, cold applications, &c., on a patient who had another aneurism on the opposite side. M. Larrey speaks of a sergeant of the guards, who received, in April 1817, a stroke from a sabre in the superior part of the right thigh; a circumscribed false aneurism was the consequence, which was speedily cured by the treatment of Valsalva, aided by the action of topical refrigerants. M. Ribes reports that Sabatier succeeded by the same means with a patient who was afflicted with two aneurisms upon the same limb—one upon the thigh and the other upon the ham.

Compression.—The observations of Arnaud, Mayer, Kinglate, Albers, and MM. Dubois and Dupuytren, prove that simple compression is capable of producing the same results. For this purpose Heister, Senf, Foubert, Ravaton, and Camper, constructed machines more or less analogous to the tourniquet of J. L. Petit; and it was for the same that Guattani and Theden so earnestly recommended their particular form of bandages. If such means cured aneurism without obliteration of the artery (as was believed until the expiration of the last century), they certainly ought to be tried before resorting to the ligature; but, since the contrary has been so abundantly proved by Scarpa, it will be found far better to have recourse immediately to the latter.

Ligature.—Ligature of the femoral is now very frequently practised. It is usually preferred, as we have seen above, in treating lesions of the popliteal artery, and even aneurisms of the leg. Many centuries elapsed, however, before any one dared to practice it. It was well known that Severin and Trullus had operated successfully for an aneurism situated at eight fingers' breadth below the groin; that Bottentuit had done the same at the Hotel Dieu, at Paris, in 1688; that Guattani had used mediate compression at the passage of the artery under the fallopian ligament with equally complete success, but nothing was then able to open the eyes of surgeons. It was only after having deeply reflected upon the numerous anastomic branches indicated by Winslow and Haller, that Heister ventured to propose ligature in certain cases of aneurism. A short time afterwards, Anel, Hamilton, Burschall, Leber, Jussy, &c., became convinced that, after the ligature, the circulation of the blood soon re-established itself in the inferior part of the limb. As the experiments that were made in England from 1760 to 1780 were, according to Pott, Wilmer, and Kirkland, much less encouraging than they

had been twenty years before in Italy, it required nothing less than the success of Desault, Hunter, and Pelletan, to bring it into honor, and cause its general adoption

The ligature may be used at any point in the length of the thigh; but not at all points with the same chance of success. As long as the profunda femoris is respected, the danger is not greater than when the operation is practised upon the popliteal artery. But when it is necessary to sacrifice the great muscular artery, it is evident that the blood can only reach the limb by the secondary branches which emerge from the pelvis. Of the three methods generally known, that of Anel is almost the only one now practised. That of Keisleyre, so frequently used by Desault, Pelletan, Deschamps, Messrs. Boyer, Roux, &c., and which prevailed so long in France, is no longer recommended, even by M. Boyer himself, in the second edition of his work, except in a few particular cases. Are there really any circumstances under which it ought to be preferred? The cases mentioned by Hodgson, and those which have occurred in England during the last thirty years, seem to prove the contrary. Nevertheless, some individuals of an imposing authority among us, have continued to use it in cases of varicose, and in diffused traumatic aneurism; particularly when the arterial tumor approaches so near to the bend of the groin as to render it impossible to place a ligature between it and the *profunda*. In 1826, I saw an operation performed in this manner by M. Roux, for an aneurism of the thigh. It was successful. It is also true, as has been observed by M. Boyer, that if the tumor extends itself to the bend of the groin, we may by opening it preserve the profunda.

It remains to be seen whether this advantage is sufficient to counterbalance the numerous inconveniences to which this method exposes us. Ligatures of the iliac have proved, that in such cases as the above the muscular artery is not indispensable to the maintenance of life in the limb. What regret, too, would a practitioner experience, if, after having emptied the aneurismal bag he found the femoral opened higher up than he had supposed; or that the walls of the superior portion were too much diseased to bear the action of the ligature!

It is not absolutely necessary, then, to open the aneurismal bag, for the purpose of tying the crural artery in any part of its length, except in aneurisms from external causes, or those which are diffused, or very voluminous and elevated.

In applying the method of Anel to the treatment of aneurisms of the inferior member, Desault aimed for the upper part of the popliteal space, and not upon the femoral artery, properly so called. M. Martin, of Marseilles, says that Spezzanni, an Italian professor, practised this mode of operation upon the thigh four years before, with the intention of disarticulating the leg when the gangrene should have become limited, and that the patient preserved his limb.

It is affirmed, on the other hand, as I have already stated, that many years before the merits of the ligature were canvassed in England, Brasdor recommended it publicly in his lectures in the schools of surgery. To Hunter, however, unquestionably belongs the merit of having first caused to be felt the importance of such a modification in the treatment of aneurism, and of having awakened the attention of the surgeons of Europe to this happy improvement. Hunter made his incision a little below the middle of the thigh, upon the internal border of the sartorious muscle, exposed the artery to the extent of three inches, and then tied it with four ligatures.

Scarpa says that the operation should be performed at four fingers' breadth

from the ligament of Poupart; that the vessel will then be most easily found; that there will be no important collateral artery to avoid; and that in operating as far as possible from the aneurism, there will be a greater probability of falling upon a healthy part of the tube, which shall be able to support the ligature.

The reasoning of Scarpa has not been universally admitted. The greater part of the French surgeons are still of opinion that, in treating aneurism of the popliteal artery, it is useless to go so high up as the inguinal space, nor even for aneurisms of the thigh, unless the seat of the disease renders it necessary. They rarely proceed so high, lest by approaching too near to the profunda they should hinder the formation of the coagulum. It is, therefore, still proper to lay down the method of tying the femoral artery in the two principal points of its extent; that is to say, above and below its middle part.

Art. 3.—*Manual.*

§ 1. *Inferior Half.*

The member is at first slightly bent and turned outwards, in order to place the muscles in a state of relaxation. An incision of about three inches in length is then made in the soft part, at such a point that half the incision shall be in the middle and half in the inferior third of the thigh. In cutting lower down, at three or four fingers' breadth above the knee, as some have recommended, the artery will not be found, as it there enters the cavity of the ham. In operating higher up, we trench upon the process of Scarpa.

In the operations of Hunter, this incision, oblique from without to within, fell upon the internal edge of the sartorius muscle, which was turned forward for the purpose of exposing the sheath of the vessels. The operator will then successively encounter the skin (generally rather thin), the adipose stratum, the saphena vein, which must be carefully avoided, the superficial lamina of the aponeurosis of the sheath of the sartorius muscle; and beneath this, deeply situated, near the femur, in the furrow which separates the vastus internus from the adductors, a second fibrous bed, to be divided.

M. Roux, on the contrary, advises that the incision should be made on the external edge of the anterior muscle, which should be pushed inwards so as to enable the operator to come at the artery. The same method was also recommended by Hutchinson, in 1811. "By it," says he, "the saphena vein will certainly be avoided, and there will be just the same number of beds to divide as by the procedure of Hunter."

Considering that in both ways it is necessary to displace the muscle which hides the vessels, turning or pushing it either inwards or outwards, Mr. Hodgson thinks that it would be better to discover the middle third of the artery, an opinion which had been already advanced by Desault, who also asserted that we may, without any bad result, cut across the fibres of this muscle whenever it embarrasses either by its presence or its contractions.

M. Lisfranc adheres to the principles of Hunter, and gives as his reasons for so doing, that an experienced surgeon cannot be arrested by the *saphena;* that by Hunter's method the wound is not so deep; and that being placed near to the internal edge of the thigh, it is easy, after the operation, to give it a dependant situation, and thus prevent the stagnation of fluids between its lips. These motives are certainly laudable, and ought to be allowed some importance. It may, however, be objected, that all practitioners are not equally skillful; that a wound, if inflicted upon the saphena, although not in itself dangerous, is likely to produce gangrene, if the crural vein should

happen to be included in the ligature or obliterated in any way whatever, as in the example cited by M. Begin; that if instead of falling upon the sheath of the sartorius muscle the operator should expose the gracilis, he would be very likely to be deceived; and lastly, that the dependent position so much insisted upon in theory, may be altogether neglected in this instance without much inconvenience. The process of M. Roux, is also liable to some mistakes. By inclining the bistoury too much towards the outside, it sometimes happens that the operator encounters the triceps muscle, and that if he do not speedily perceive his error, the case becomes very laborious and is seldom terminated without injurious results. To escape these inconveniences, it is only necessary to remember that the fibres of the sartorius are parallel to each other and to the axis of the muscle, and also that of the member, and are without any admixture of fat; whilst those of the vastus internus are collected into fasciculi, mixed with cellular or adipose *lamellæ*, and *are all oblique*, from above to below, from rear to front, and from the internal border towards the median line of the thigh. However this may be, the wisest course is, in my opinion, to conform to the advice either of Hodgson or Desault, by which, after dividing the first aponeurosis, the operator may arrive with facility either upon the inner or outer edge of the sartorius; and afterwards avail himself, with equal advantage, of the practice either of Roux or of Lisfranc. As to the division of the muscle, recommended by Desault, although not now thought so dangerous as formerly, it ought not to be practised but upon occasions of absolute necessity. In theory, it is difficult to conceive that it can ever be required, except in operating by the old method.

§ 2. *Superior Half.*

Above the middle of the thigh, an incision of about three inches in length is commonly sufficient to discover the trunk of the femoral. The middle part of this incision should be four fingers' breadth from the fallopian ligament, unless an absolute necessity should exist for making it immediately under the crural arch, so as to fall between the *profunda* and the epigastric. In all cases, the bistoury should take the direction of the line represented by the passage of the vessel, and should incline a little outwardly rather than inwardly, on account of the saphena. After the skin and the adipose stratum, is seen the aponeurosis. Before dividing this, it should be recollected, that low down the internal edge of the sartorius usually separates this lamina from the artery, which cannot take place in the upper part of the inguinal triangle. This lamina being opened, and the muscle thrust outwards as far as necessary, the operator passes a grooved director (to serve as a conductor for the bistoury) under the superficial layer of the arterial sheath, and then makes, without danger, an incision of the same extent with the external wound. Finally, he isolates the vessel, taking it on its internal side, and using extreme caution to avoid wounding the crural vein or the neighboring nerves.

§ 2. *Results of the Operation.*

After the preceding operation, whether performed high up or low down, the vessels charged with the re-establishment of the circulation are, in either case, the same. The branches of the superficial muscular pour their fluid into the anastomica magna, the external articular, or the recurrent tibial; and those of the profunda or of the perforating arteries, into the internal articulars. The blood sometimes finds its way, by means of the muscular branches intervening between the ligature and the tumor, preserves the pulsations, and

sometimes delays considerably the resolution of the aneurism. This inconvenience, which at first appeared serious, no longer gives much uneasiness. Cold and discutient applications, aided by a gentle pressure, will generally cause the tumor to disappear, when it is not thought better to abandon it to its own action. Yet facts contradictory of the above are more numerous and authentic than would be supposed. Mr. Monteith, of Glasgow, has seen the pulsations reappear several months after an apparent cure. An aneurism, operated upon by Mr. Cumming in 1821, reappeared in 1825, so as to render it necessary to amputate the thigh. In a case in which I had tied the femoral three inches below the profunda, hemorrhage manifested itself at the coming away of the ligature on the thirteenth day.

When it has not been possible to preserve the profunda, the circulation is established by the branches of the hypogastric. The gluteal, the ischiatic, the internal pudic, and the obturator arteries communicate with the circumflex and perforating arteries, and the latter then empty themselves into the arteries which encircle the knee. If those aneurismal tumors which develop themselves in the substance of the bones—tumors which were first observed by Pott and Scarpa, of which Pelletan cites several examples, and which have been observed three times at the Hotel Dieu by M. Dupuytren—if such tumors should make their appearance on the leg or upon the thigh, it would not be necessary in all cases, as it was formerly believed, to amputate the limb. The ligature of the femoral, by Anel's method, would be found sufficient. It was used with complete success by Mr. Pearson, and M. Lallemand of Montpellier.

Caustics, astringents, styptics, immediate compression, gradual obliteration, and temporary ligatures, have also been tried upon the crural artery. In the case of a young and robust man, twenty-two years of age, who labored under an aneurism of the superior third of the thigh, produced by a sabre-stroke, Sabatier, after having opened the aneurismal sac and placed two precautionary ligatures under the artery, contented himself with filling the wound with compresses and a pyramid of agaric, confined with a bandage. His patient was cured at the expiration of two months. M. Dubois succeeded upon one occasion, with his compressing forceps (*pince presse artere*), and Scarpa, and several surgeons of London, have been so fortunate as to be able to remove the ligature three or four days after having fixed it upon the artery.

G. Ligature of the Circumflexes or of the Profunda.

When one of the circumflexes or the profunda has been wounded, or has become the seat of aneurism, there is generally little difficulty in applying the ligature. The essential point is to ascertain such a lesion. By exposing the trunk of the femoral at the place where it emerges from under the crural arch, a thread may be easily applied upon the rest of the affected artery. M. Roux, however, is the only surgeon who to my knowledge has had occasion to operate upon one of the secondary branches.

H. External Iliac.

Art. 1.—*Anatomical Remarks.*

From the level of the sacro-iliac symphysis, where the primitive iliac artery divides, to its arrival at the fallopian ligament, the external iliac represents a line slightly curved, with its convexity looking outward and backward, and

more marked in the female than in the male; and so much the more as the pelvis is larger, or the superior strait more depressed. It rests upon the psoas muscles on the outside, and upon the iliac vein within and behind, and is covered immediately by an expansion of the *fascia-iliaca.* The crural nerve is separated from it by the tendon of the psoas, and by an aponeurosis of great strength. A branch of the *genito-crural* nerve sometimes runs along its internal and anterior surface, which is crossed by the ureters, and in the female by the ovarial vessels. The peritoneum which hides all these different objects, adheres to it slightly by means of a very loose lamellar and adipose stratum, and leaves it altogether in front, in order to return upon the posterior surface of the abdominal parietes. At its entrance into the crural canal, it again gradually rises, becomes more superficial, and forms new connexions. In this latter position it is supported by the body of the pubis, and by the origin of the pectineus muscle; the vas deferens crosses it to bury itself in the pelvis, and the spermatic cord does the same in passing through the inguinal canal. The epigastric vein is also obliged to cross the inguinal canal to open into the iliac vein, which lies attached to it as in the thigh; the fibrous lamina which confines it against the psoas and iliacus, here becomes perceptibly thinner. The circumflexa ilii and the epigastric (the only branches which it furnishes) separate from it, the one a little on the outside, and the other a little on the inside, generally on a level with the linea ileo pectinea, but sometimes four, six, or eight lines higher or lower. The lymphatic ganglions which surround it until it reaches the crural arch, and possess the power of compressing it by swelling, have given birth to apprehensions of disease which have no foundation in reality. The cœcum on the right, and the sigmoid flexure of the colon on the left, are the only viscera by which it is separated from the parietes of the abdomen. Nothing is more easy with patients of a meagre habit, and when all the muscles are in a state of relaxation, than to establish upon it a mediate compression capable of suspending for the time the circulation in the limb, as has been demonstrated by Bogros, and as I have myself proved in the case of a young man who had received a cut over the epigastric, to which artery I applied the ligature. Its anomalies are almost exclusively confined to its length, its volume, its curvature, and the points of origin of its principal arteries. It is possible, however, that it may consist of two trunks placed side by side, and which pass together under the crural arch, as was remarked by Mr. James, in a case where he had tied the iliac artery after the method of Brasdor.

Art. 2.—Surgical and Historical Remarks.

The external iliac artery is seldom the seat of other than spontaneous aneurisms. If it were opened in fact by any exterior agent, the hemorrhage which would ensue would cause the death of the patient before it would be possible to render him the least assistance. Yet M. Larrey says that he has seen it in the subject of a varicose aneurism. And since it is not in an exposed situation, and is not more than four or five inches in length, even aneurism occurring in it from internal causes can scarcely be very common. The case of the young man just mentioned who recovered after the operation, is almost the only one of its species, as will be subsequently seen.

If the fear of gangrene after the obliteration of a great arterial trunk has been able for so many ages to restrain surgeons in their treatment of aneurisms of the thigh and popliteal region, much more reason is there why they should reject the mere idea of tying one of the primary divisions of the aorta.

Facts passed unnoticed, science could not profit by them. In the practice of Guattani compression was established upon the femoral above the profunda, and the circulation continued in the limb. Baillie, in a dead subject found the femoral obliterated as far as the interior of the pelvis, while the inferior extremity was not in the slightest degree affected. A similar case came under the observation of Guattani, in 1767: his patient had labored under an inguinal aneurism, and had been cured by the use of compression. In the dead body of a patient treated by Gavina, in 1775, the iliac artery itself was found to be completely impermeable. Similar cases have been reported by Clarke and others. All these proofs, the injections practised by Guattani, and even those of Scarpa, which demonstrate the facility with which fluids forced into the aorta pass into the arteries of the thigh and leg, notwithstanding the previous ligature of the external iliac, were insufficient, and might perhaps have remained long unapplied, had not Abernethy been obliged to appeal to them for the first time, in 1796. An individual who had already undergone an operation according to the method of Anel for aneurism of the popliteal trunk, came to St. Bartholomew's hospital affected with an inguinal aneurism on the opposite side. Abernethy applied a ligature below the crural arch; a hemorrhage, which took place fifteen days afterwards, left him no other resource than to penetrate into the abdomen, and to perform upon the iliac artery the same operation which he had previously performed upon the femoral. The patient expired sometime afterwards, in consequence of a second hemorrhage. Another operation performed by Abernethy was attended with the same unfortunate result; but the third, in 1806, was completely successful. Previously to this period no one spoke of the possibility of tying the external iliac, without causing the mortification of the limb; now it is one of the most common operations in surgery.

Mr. Freer, in 1806, Mr. Tomlinson, in 1807, imitated Abernethy, and with like success. Mr. Tomlinson again successfully performed this operation in 1809. Four out of seven patients on whom Sir A. Cooper operated, in 1814, recovered; the remainder died, one at the expiration of three months of an aneurism of the aorta, another from mortification of the limb, and the third from hemorrhage. M. Delaporte, of Brest, was the first French surgeon who had the courage to follow the example of the English practitioners; his patient died of a putrid fever on the twelfth day after the operation. Messrs. Goodlad and Dorsey each performed the operation successfully, in 1811; M. Bouchet of Lyons, also succeeded in curing a Spanish prisoner, in 1812; the latter died the next year of an aneurism of the opposite side. The same year a patient under the care of M. Albert died of tetanus the twentieth day after the operation. An old man of seventy-five years of age, in the hands of Mr. Ramsden, sank on the third day. In 1813, two successful cases rewarded the efforts of Messrs. Brodie and Norman. Mr. Lawrence succeeded in his turn, in 1814; as also M. Moulaud, of Marseilles, in 1815; but gangrene occurring on the fourth, destroyed the hopes of Mr. Collier of a similar result. Messrs. Smith, Soden, and Dupuytren were less unfortunate: each saved the life of a patient in 1816. Mr. Cole, in 1817; M. Albert, in 1818; and Messrs. Wilmot, Kirby, Newbegin, and Post, successively added themselves to the list. The patient of M. Salmon died on the 16th day. Messrs. Wright, Richerand, Vacca, Killian, White, Dacrux, and Clot, deserve the credit of having performed this operation with success. M. Delpech was not so fortunate; the patient under his care died in a few days. M. Tait, in 1825 and 1826, tied successively the two iliac arteries of the same patient, and with complete success, although on one side the peritoneum was wounded

in the operation. M. Arendt, in a similar case, left an interval of only eight days between the two operations, and was equally successful. I performed the operation myself on the 6th of October. The ligature came away on the 11th day, and the patient was perfectly cured. This case was a remarkable one. The patient, a young man, seventeen years of age, large and strong, in clearing a table in a dark place, accidentally forced a butcher's knife into his groin, and cut across the external iliac artery three lines above the origin of the epigastric; the blood issued from the wound in torrents. Drs. Layraud and Durand, who attended almost immediately, compressed the artery at two inches above the wound, and thus suspended the hemorrhage until my arrival. Assisted by these two gentlemen and by M. Duvivier, I hastened to expose and tie the injured vessel. No unpleasant symptoms manifested themselves in the limb; the emission of urine was somewhat difficult during the second day, but afterwards became free; inflammatory symptoms about the side during one week gave us some uneasiness; a first ligature placed very high up with a curved needle, in order to afford perfect freedom in seeking the seat of the wound, did not detach itself until the thirty-fifth day; but at length the wound cleansed itself, and the health of the young man is now perfectly re-established. This case demonstrates the importance of knowing how to compress the iliac arteries in the pelvis through the parietes of the abdomen, and proves—first, that without preventing dilatation of the collateral branches, whether occasioned by compression, as has been proposed, or by the presence of an aneurism, the ligature of the ileo-crural trunk may be practised with success; secondly, that the sudden and complete division of that trunk is not absolutely mortal. It is proper, however, to mention that a patient on whom Beclard operated, in 1822, died of hemorrhage on the thirteenth or fourteenth day; and that a similar fate was met by an individual under the care of M. Dupuytren, in 1823 or 1824. The operation has been successfully performed forty times from the period of its adoption up to the present day.

Art. 3.—Manual.

Notwithstanding the two examples of cure by refrigerants, moxas, and a weakening regimen, which have been so recently made known by M. Larrey, the ligature ought always to be preferred in such cases of iliac or inguinal aneurism as will permit its application, and when the patient is willing to submit. It should be remembered, however, that in carrying it more than three inches into the pelvis, the neighborhood of the hypogastric renders the operation very hazardous; so that instead of going as high as the primitive iliac when the tumor occupies the iliac fossa, and there is not room enough left in the groin for tying the femoral above the profunda, it will be right to resort to the method of Brasdor. The patient of Sir A. Cooper lived two months after the operation; the pulsations had ceased in the tumor, which was enormous, and it is not possible precisely to account for his death. In the patient of Mr. James, who was not more fortunate, the iliac artery was divided into two nearly equal trunks. Yet the fruitless attempt of Mr. White, although the femoral was obliterated below the tumor; the pulsations which continued to be felt at the bottom of the wound in the young man whose case has been just related, and the facts recorded by Mr. Guthrie, prevent us from placing much confidence in this latter method. To practice it with any possibility of success, it is necessary at least to be able to place a ligature between the tumor and the origin of the epigastric arteries and the circumflexa ilii; or else that those branches should have been displaced by the aneurism filled with coagula and

rendered impermeable by the pathological process described by M. Berard. Numerous processes have been followed for the purpose of arriving at the external iliac artery.

1. *Process of Abernethy.*—On the first occasion, Abernethy made an incision of about three inches in the direction of the vessel above the ligament of Poupart. This method has been recommended anew by M. Begin, in the Dict. de Med. et de Chir. Pratique. Upon his second patient, Abernethy, fearing to wound the epigastric artery, made the incision a little more to the outside of the inguinal ring, giving it a slightly oblique direction upwards and outwards so as more easily to avoid the peritoneum.

2. *Process of Sir A. Cooper.*—Sir A. Cooper made an incision in the form of a half-moon, in the direction of the fibres of the tendon of the external oblique—that is to say, with a convexit downwards, and beginning at a little distance from the anterior superior spinous process of the ileum, and terminating near the inguinal ring; on raising the semilunar flap thus formed, the operator perceives the spermatic cord, the opening in the *fascia transversalis*, and the epigastric artery; by passing the finger beneath the cord, through this opening, "he will then," says this author, "easily arrive at the iliac vessels."

3. *Process of Mr. Norman, of Bath, and of Mr. Roux.*—Mr. Norman contented himself with making an incision in the direction of the fallopian ligament, and afterwards following the directions of Sir Astley Cooper. M. Roux recommends that the incision should commence a little above, and about half an inch distant from the spine of the ileum, and terminate upon the middle of the crural arch.

4. *Process of Bogros.*—M. Bogros believes that the method of Sir A. Cooper, or of Mr. Norman, might be advantageously modified, by directing the middle of the incision upon that point of the ligament of Poupart which corresponds with the artery, and afterwards gaining the opening in the *fascia transversalis*, for the purpose of finding with certainty the epigastric, which will then serve as a guide to the iliac trunk.

5. *Process adopted by the Author.*—The following method has appeared to me the most simple and easy of application. The patient is laid upon his back, with the limb moderately extended and retained in its position by assistants. The operator then places himself on the side of the aneurism, and makes a slightly curved incision, three inches in length, parallel with and a little above the fallopian ligament; the middle part of the incision is on a level with the artery. The first stroke of the bistoury passes through the skin and the *fascia superficialis;* if the flow of the blood from the branches of the external epigastric artery is so great as to impede the operation, the ligature or torsion is applied before proceeding further. The aponeurosis of the external oblique next presents itself. For greater security, it is well, though not indispensable, before making the incision to pass under this tissue a grooved director. The fibres of the lesser oblique muscle are next seen, which may be divided without fear by an experienced surgeon with the cutting instrument; otherwise their inferior extremity is to be detached with the point of a director, pushing them backward and upwards with a certain degree of force, while the left index finger fixes and retains the inferior edge of the wound; the *fascia transversalis* is then torn in the same manner as far as the spermatic cord, which is pushed aside in the same direction as the fleshy fibres. From this point, in order to avoid the peritoneum, particularly when the ligature is to be carried upon a very elevated point of the iliac fossa, the finger should be used instead of the sound; in other cases the latter is preferable. After having proceeded thus far, if the eye of the operator cannot

distinguish the objects, the fore-finger thrust into the wound, the lips of which should be kept separate, will easily feel the artery upon the internal edge of the psoas and the side of the superior strait. By taking it up between the fingers, as has been recommended by Scarpa and practised by many surgeons, useless, and sometimes dangerous lacerations are produced. It is infinitely better to penetrate with the director the sheath which it receives from the fascia iliaca, directing the beak of the instrument upon its internal side, and detaching it from the vein by careful movements to and fro. After this separation, which should be of as small an extent as possible, but yet should comprise the whole circumference of the artery so as to disunite it completely from the iliac vein and from the nervous branch which crosses their surface, the operator, in order to pass the ligature, may make use of an eye-probe conducted along a director, or of the needle of Deschamps, or any other convenient instrument. It is better to apply the ligature a little too high than too low; it is at least necessary to place it above the epigastric. Beclard is said to have lost one of his patients by having unintentionally placed the ligature *below*, instead of *above* that branch. In consequence of this danger also, and in order to avoid it with greater certainty, Bogros recommends the exposure of the epigastric before seeking the iliac artery; but in proceeding as I have just directed, where the iliac has been discovered, it will always be easy to find the epigastric, and to leave it below the ligature. In order to prevent hemorrhage, or the return of the blood, and the continuance of pulsation in the tumor, which may be produced by the artery, some think it necessary to tie the latter, whether wounded or not, at the same time with the iliac artery. Though this advice may be followed without much inconvenience, the practice up to the present time has proved that it is by no means indispensable. During the operation, but particularly at its termination, it is of the highest importance that the abdominal muscles be kept in a state of relaxation, and that the patient should refrain from any effort from making the slightest movement, otherwise the intestines will certainly present themselves at the incision, and a wound of the peritoneum will be the almost inevitable consequence; and although such an injury is not of so much importance as has been generally supposed, as we see in the instances mentioned by Messrs. Post and Tait, yet it ought to be guarded against with the greatest care.

Advantages and Disadvantages of the Different Modes of Operation.—The vertical incision, or that parallel with the artery, and the oblique incisions of Abernethy and M. Roux, present but one advantage—that of enabling the operator to penetrate without much difficulty as high as he pleases—an advantage which is amply counterbalanced by the greater risk which he incurs of wounding the peritoneum. The inferior or internal angle of the wound is the only point where it is possible to separate its lips, in order to search for the vessel; and it is perfectly useless to give a greater extent to the division of the abdominal parietes.

In the process of Sir A. Cooper, modified by Norman and Bogros, as well as in that upon which I have just commented, the incision, crossing the vessel almost at a right angle, renders it impossible to miss it. True, it is objected that this method does not permit the operator to reach high up in the pelvis, and that it renders him more liable to wound the epigastric artery. But on the one point it is possible by its aid to proceed to the depth of three inches, and if the aneurism rises higher, it is the primitive and not the external iliac that the operator must endeavor to tie; and on the other, since the tissues are divided, lamina by lamina, and torn rather than cut from the place where the operator reaches the deep aponeurosis, sometimes long

before, I cannot see how it is possible, unless by design, to wound the epigastric which lies behind. Experience has proved that it is possible to use successfully any of the methods which have been above described, and I am perfectly aware that the question as to which is the best, is more a matter of choice than of necessity, except that the transverse incision, which is always sufficient when the tumor does not extend above the crural ligament, may not be so convenient when the disease has reached a higher point. It is, however, for the skillful surgeon to adopt those means which seem most applicable to the cases which may come under his hands.

The blood is conveyed into the inferior extremity after the ligature in the iliac artery, in the same manner as after the ligature of the femoral above the profunda—by the gluteal, the ischiatic, the pudic, the obturator, and further by the epigastric and the circumflexa ilii, by means of their anastomoses, with the internal mammary, the lumbar, and the ilio lumbalis. The proximity of the urinary and seminal passages, of the *peritoneum* and of the lax cellular tissue of the iliac or lumbar region, demands all the attention of the practitioner, and prompt relief when the slightest accidents occur from that quarter. For the rest, such symptoms are to be treated by the means generally known.

I. Internal Iliac.

Art. 1.—*Anatomical Remarks.*

The internal iliac, leaving the primitive iliac on a level with the sacro-iliac symphysis, separates from the external iliac, and descends almost perpendicularly into the hollow of the pelvis. Its external surface is crossed at its origin by the iliac vein, and accompanied in the rest of its extent by the hypogastric vein, which separates it from the psoas muscle and the articulation. On the inside it is united to the peritoneum only by a cellulo-adipose stratum, varying in thickness; some lymphatic ganglions also rest against it on the same side. The urethra commonly passes above and a little more in front; to the left, the commencement of the rectum covers it, but at a greater distance; on the left its relations to the cœcum scarcely deserve attention. It is not possible to reach it, except in the part between its origin and that of the gluteal, an extent of from one to two inches—in a word, as far as the level of the great sciatic notch. The ilio-lumbalis, which it sometimes gives off in its passage, and which then immediately proceeds outward and upwards between the psoas muscle and the bones, should also be noticed, although the primitive iliac artery or the external, more frequently give it off.

Art. 2.—*Surgical and Historical Remarks.*

The trunk of the hypogastric artery is too deeply situated to be frequently the seat of traumatic lesions, and is too short to be susceptible of relief in any aneurisms which may affect it. Sandifort is the only one who has ever reported a case of aneurism of this artery; but it is not so with its principal branches. After leaving the pelvis they are still sufficiently voluminous to become the source of dangerous hemorrhage in the event of their being wounded or experiencing spontaneous rupture; the gluteal artery particularly, which is distributed to the muscles of the same name, and which cannot, like the ischiatic or the pudic, be easily taken up from without, has several times produced death in this way. Thedan reports an instance. In dilating

a gun-shot wound, a surgeon divided the gluteal artery, and the unhappy soldier very soon expired. The same occurred in a case of aneurism, on the patient mentioned by Jeffreys, of Glasgow. J. Bell, it is true, was more fortunate; he saved the life of his patient by tying the wounded vessel. Mr. Rogers has since made known an analogous case; and, in 1817, Mr. Brooke cured, or believed that he had cured, a gluteal aneurism by compression, digitalis, and laxatives. Yet it cannot be disputed that ligature of the internal iliac is the only method which can be counted upon for relief in most cases of this kind.

Art. 3.—*Manual.*

This operation was performed for the first time by Mr. Stevens, upon a negress, who had in the left buttock an aneurism as large as the head of an infant. The woman was completely cured, and lived some years afterwards to die of another disease. Dr. Stevens, professor of surgery in New York, informed me that he had seen the pathological preparation, fully bearing out the assertions of the surgeon at Santa Cruz. On the 12th of May, 1817, Mr. Atkinson, of York, followed the example of Mr. Stevens, upon a boatman, who was in the same situation as the negress Maila: several hemorrhages and an abundant suppuration brought on death at the expiration of twenty days. Since then, Dr. Pomeroy White, of Hudson, in America, has been more successful. He operated upon a tailor sixty years of age. A great deal of pus issued from the parts during a month, but the health of the patient was eventually re-established.

Processes.—1. Mr. Stevens at first divided the integuments, the aponeurosis, and the muscles, to the extent of five inches, a little without, and in the direction of the epigastric artery; then, having detached the peritoneum, pushing it towards the axis of the body from the spine of the ileum and the division of the primitive iliac artery, he isolated the hypogastric trunk with the fore-finger, and applied the ligature half an inch below its origin.

2. Mr. Atkinson followed the same method; but a profuse hemorrhage obliged him to thrust the whole of his fingers into the iliac fossa, in order to reach and tie the artery.

3. Dr. Pomeroy White made an incision upon the side of the abdomen, in the form of a half moon and about seven inches in length, the convex part turned towards the ileum. This incision commenced near the umbilicus, and terminated near the inguinal ring. After having thus divided the whole thickness of the abdominal walls, tied several arteries, and detached the peritoneum, he raised the hypogastric trunk with the handle of his scalpel, and tied it an inch below the point of its origin, using afterwards sutures and adhesive plasters to close the external wound.

As this operation is performed upon healthy parts far from the seat of the disease, it is easy to practise it upon a dead subject, and to become assured that an incision of five inches, as made by Mr. Stevens, is sufficient, and is even preferable to that recommended by Dr. White, because it enables the operator to avoid all the branches of the epigastric without risk of wounding the anterior iliac.

4. *Another Method.*—The operation may be performed, I think, with equal success, by prolonging about two inches the external extremity of the incision recommended by Sir A. Cooper for the ligature of the external iliac. This mode of procedure was preferred by Dr. Anderson, of New York, "in order," says he, "more easily to preserve the peritoneum, and to prevent the

consecutive hernia, which occurred to a patient under the care of Mr. Kirby, as well as on the negress of Mr. Stevens." The incision advised by Abernethy, is as eligible on this score as any other; whatever method, however, may be adopted, great care must be taken not to scrape the peritoneum, or lay it too bare of cellular tissue, in separating it with the fore-finger from the parts to which it is attached. Having reached the internal edge of the psoas, the finger is also used in separating the artery from the large veins which partly hide it. The root of this trunk, like that of the external iliac, is to be bent downwards and towards the centre of the pelvis; then, aided by the needle of Deschamps, the double curved needle of M. Causse, or a flexible probe with an eye at its beak, the operator passes the ligature. The greatest caution is here necessary; the venous trunks should be carefully avoided; their sides are thin; nothing is more easy than to injure them. In displacing the artery also, there is a possibility of wounding the *ilio-lumbalis* and producing a dangerous effusion of blood.

Result of the Operation.—The ligature of this artery, although it may at the first view excite apprehensions in the mind of the operator, is in reality less serious as to its effect upon the circulation, than that of the external iliac or even the femoral. It in fact leaves untouched all the vessels proper to the corresponding member, and the two hypogastric arteries communicate by means of anastomoses so large and numerous, that after the obliteration of the one the blood easily finds its way by the other into the viscera, which they nourish. But it is dangerous in other respects; at first from the difficulties attending its execution, and afterwards from the separation which it is necessary to make in an abundant cellular tissue, and from which inflammation and suppuration are so easily propagated to a great extent.

K. Primitive Iliac.

Art. 1.—*Anatomical Remarks.*

Two causes effect a variation in the length of the common iliac; first, the aorta often divides upon the body of the fourth lumbar vertebra instead of the fifth; secondly, the root of the secondary iliacs may be found nearer than ordinary to the sacro-vertebral angle. One may also be sometimes found larger than the other, because the trunk from which they originate does not always lie upon the median line; still, with some few exceptions, their length scarcely ever varies more than from three or four lines to an inch. They rest upon the side of the *sacro-vertebral* angle, upon the wings of the *sacrum*, and against the internal face of the psoas muscles. On the right, the vein is first in the outside, and then behind; on the left, on the contrary, it lies all the way on the inside, and does not reach the artery until after having previously passed under the root of the arterial trunk of the opposite side; these vessels are covered only by the peritoneum, so that in attenuated subjects it is still more easy to compress them than the external iliacs, provided always that the operator has previously removed the mass of the small intestines.

Art. 2.—*Surgical and Historical Remarks.*

Bogros opened the body of a patient who had been wounded in the primitive iliac by a pistol ball thirty-six hours before death. Dr. Gibson, of Baltimore, reports a case precisely similar; we may easily conceive that aneu-

risms may prolong themselves from the two secondary iliacs to the common iliac, and even invade it primarily.

It needed more than common hardihood to undertake the obliteration of an arterial trunk so voluminous, so near to the aorta, and so deeply situated. In default of the external iliac the blood passes into the limb by the internal iliac; in default of one hypogastric, that fluid is furnished by the other; but what can supply the place of the common iliac? Who can deprive a fifth of the body of its circulation without producing death? many surgeons still believe it to be impossible. Yet Mr. Goodison, in 1818, remarked upon the body of an old woman which he dissected at *La Pitie*, the complete obliteration of the two primitive iliacs, without the lower extremities appearing in any way to have suffered. The experiments also upon dogs, made by A. Cooper and Beclard, together with those of Scarpa, had already solved the problem. Were these facts sufficiently numerous and conclusive to warrant actual application upon the person of a living subject? Practice has replied in the affirmative; and if refrigerants, a weakening regimen, laxatives, and digitalis have failed; if the aneurism rises so high as to render the ligature of the external iliac uncertain and insufficient, and to prevent or render useless the method of Brasdor; if there is, in fact, no other resource, the ligature of the primitive iliac ought to be practised.

Mr. Gibson, it is true, tried it unsuccessfully in the case above mentioned; but Professor V. Mott, who practised it for the first time according to fixed rules, on the 15th March, 1827, for an aneurism of considerable extent, saved the life of his patient. The year following, Mr. Crampton, in endeavoring to imitate the skillful practitioner of New York, was not so fortunate; his patient died of hemorrhage on the fourth day. This latter case, is nevertheless extremely important; the circulation, the warmth, and the sensibility, for a time suspended, were afterwards completely renewed in the limb; every thing announced complete success, when the ligature seemed to displace itself, and symptoms of internal hemorrhage disappointed these flattering hopes. On opening the body every thing tended to confirm the belief that the cord of animal matter, employed by Mr. Crampton, had been dissolved or broke before the artery was obliterated. The authenticity of the last two mentioned operations is sufficiently guaranteed by the names of the operators; the one enjoys a justly merited estimation and celebrity in America and throughout Europe, and the other is at the head of a public establishment—a hospital in England.

Art. 3.—*Manual.*

The mode of procedure to be followed is exactly the same as for the ligature of the internal iliac. Dr. Mott commenced his incision on the outside of the inguinal ring, half an inch above the ligament of Poupart, and carried it above the superior spinous process of the ileum, giving to it a semicircular direction and an extent of about eight inches. The incision of Mr. Crampton was also in a semicircular form, the concavity towards the umbilicus and about seven inches in length. It extended from the last rib to the superior and anterior part of the crest of the ileum. Both operators detached the peritoneum with the fingers; and there is no circumstance which tends to prove that they experienced any difficulty in reaching or in tying the vessel.

Here the circulation of the fluids is re-established by the anastomoses of the internal mammary and of the epigastric of the last lumbar and circumflexa

ilii or the *ilio lumbalis*, and then by the branches of the hypogastric of the healthy side with those of the side affected.

L. Abdominal Aorta.

Art. 1.—*Anatomical Remarks.*

The abdominal aorta is placed upon the front and a little to the left of the bodies of the vertebræ, accompanied by the vena cava on the right; enveloped by a fibro-cellular sheath; crossed behind by the lumbar veins; in front by the pancreas, the duodenum, the splenic vein or the trunk of the vena-portæ, and the left venal; and surrounded by vessels and lymphatic ganglions. It has in front, the stomach, the transverse meso-colon, and the root of the mesentery; and from its passage between the pillars of the diaphragm to its bifurcation above the sacro-vertebral angle, furnishes a great number of branches worthy of notice. The cœliac, the emulgent, and the great mesenteric, derive their origin from its superior half, that is to say, they originate above or in the meso-colic portion of the mesentery. A great interval consequently separates them from the inferior mesenteric, which is given off at an inch and a half or two inches above the common iliacs. In crossing the body of the vertebræ, the lumbar arteries pass under small fibrous arches, extremely firm, and thus, like fixed roots, prevent the displacement of the aorta in either direction more than a few lines, unless they are themselves previously broken.

From what has been said it is plain that by pushing to the right the small intestines, or removing them in any way, it will be easy to compress the aorta against the vertebræ, either between the two mesenteries or immediately above its bifurcation; that these are the only points at which it is accessible to the surgeon, and that over one or the other of these the thumb should be applied so as to act through the abdominal parietes when it becomes necessary to suspend a serious hemorrhage of the inferior arterial system.

Art. 2.—*Historical and Surgical Remarks.*

No artery of the splanchnic cavities is more frequently the seat of aneurisms from internal causes, than the abdominal aorta; and no where does aneurism or the slightest traumatic lesion occasion greater danger, or is it more constantly followed by death. If it be true, and it is scarcely possible at the present day to doubt it, that obliteration of the affected vessel is required for the cure of any wound, ulceration, or solution of the continuity in its coats, how is it possible to conceive that such a state, supposing it possible in the aorta, could be induced there without fatal consequences? The following facts, however, prove that even this artery may be obliterated without causing death:—

1st. Stenzel states that he found two steatomatous tumors in the very thickness of the sides of the aorta below its arch. The arterial trunk was almost impermeable to the blood, and yet nothing during life had indicated the existence of such a disposition of parts.

2d and 3d. In two bodies, the inferior extremities of which were well supplied with blood, Meckel found the aorta considerably contracted below its arch.

4th. M. A. Severin speaks of a subject in which the aorta was completely closed below the emulgent arteries by a solid concretion.

5th. Staerk cites a case similar to those of Meckel.

6th. Paris saw the aorta so much contracted for several lines below the

arch, that he had great difficulty in introducing a crow-quill into the passage: Brasdor saw this preparation in the cabinet of Desault.

7th. An instance of complete obliteration at the same point of the parent artery, is related by Graham in the Medico-Chirurgical Transactions.

8th. Mr. Rainy states that he observed a similar case at the Glasgow Hospital in 1814, and that he presented the preparation to Mr. Monteith. May not this be the case alluded to by Mr. Graham?

9th. Doctor Monro mentions an example of the aorta obliterated immediately above the primitive iliacs, by the remains of an old aneurism.

10th. A similar case came under the observation of Mr. Goodisson, in which the obliteration had extended to the two common iliacs.

11th. M. Reynaud has recently made known an additional case of extreme contraction of the thoracic aorta.

Lastly. A peasant, thirty-three years of age, died suddenly in the beginning of February 1828, after having suffered during fifteen or twenty days from a painful gastric affection. On opening the body, M. A. Meckel discovered that the death of the patient had proceeded from an injury of the auricle of the heart, and afterwards perceived that the aorta was so contracted as scarcely to allow the passage of a straw. Mr. Crampton, of Dublin, also mentions a case of complete obliteration of the abdominal aorta. Sir A. Cooper says that his attention was directed to another case of this kind, and that a similar one was also witnessed by M. Larrey. Mr. Key also, has recently published another example in the case of a paraplegiac.

In nearly all the above cases, the state of the aorta was evidently the result of disease, and in all, the circulation continued below the interception. The patients spoken of by Messrs. Rainy and Key, were the only ones who complained of habitual feebleness in the legs or of paralysis. Messrs. A. Cooper and Beclard, in their experiments upon dogs, are said several times to have tied the ventral aorta without producing gangrene. In 1813, I dissected a cat, upon which M. Pinel Grandechamp had four months before practised this operation. The animal had perfectly recovered, and the abdominal aorta was transformed into a fibro-cellulous filament, from the superior mesenteric to the origin of the primitive iliacs. M. Scoutetten obliterated successively the two femorals, the two carotids, and the two subclavians of a dog, and afterwards tied the aorta without producing death. The animal lived six days, although an intense *peritonitis* developed itself the morning after the operation, when a laceration of the aorta took place above the ligature on the seventh day, and caused the animal to die suddenly.

If the above facts do not authorize the conclusion that ligature of the ventral aorta may without temerity be practised upon a human subject, they prove at least and most incontestably, that the blood would find some other way to reach the inferior members. The intercostals and the superior lumbars, the internal and external mammaries, the transverse and posterior cervicals, are sufficiently voluminous, in fact, to convey the fluids to the parts below the ligature. By examining the engraving which accompanies the observations of M. Reynaud, together with what has been said of it by Graham, Paris, Al. Meckel, &c., the reader will immediately comprehend the great resources possessed by the system in these cases. Moreover, if the thread is placed between the two mesenterics, instead of below them, large arches will be formed by the meeting of the right and left colic branches. The human body is in reality but a vast net-work—a great vascular circle—and no one need now fear that the course of the fluids can be arrested by the obliteration of any one of its points.

Let us now consider whether the ligature of the aorta is useful and practicable. Practicable it certainly is, for Messrs. Cooper and James have performed it, but its utility has not been yet so conclusively demonstrated. For aneurism of one or both common iliacs, and for those which develop themselves above the superior mesenteric, there appears to be no other resort—and the observations of Messrs. Monro and Goodisson, the case of spontaneous cure of an aneurism of the aortic arch, published by Dr. W. Darrah, of Philadelphia, and a similar case mentioned by M. Calmeil, prove the power of the organization under circumstances like these. Internal treatment, cold topical applications, moxas, the combined methods of Valsalva, of Guerin and of M. Larrey—do not these means offer greater chances of success than all the operations that could be continued? Time and the experience of able practitioners will eventually solve this grave problem; in the mean time, as it may become necessary to imitate the attempt of the English surgeon, I shall give the rules for the operation.

Art. 3.—*Manual.*

I do not see any merit in the idea of penetrating the left side, so as to reach the aorta without opening the peritoneum; on the contrary, I am of opinion that such a method ought never to be resorted to. If it is doubtful whether it might not be applied in nephrotomy, or in forming an artificial anus, it is certain that, for ligature of the aorta, it ought not even to be thought of. The only method which can be prudently attempted is the following:—

The patient should lie upon his back, with the head, the thighs, and the legs moderately flexed, so as to place the parietes of the abdomen in a state of perfect relaxation. An incision three or four inches in length is then made upon the linea alba, a little to the left, in order to avoid the umbilicus—above which I think it will be found convenient to extend it a little farther than below. Having arrived at the peritoneum, the operator pierces it to divide it more extensively with a probe-pointed bistoury conducted upon the finger; by this opening the fore-finger removes the intestines, penetrates to the vertebral column, distinguishes the pulsations of the artery, separates with the nail the left lamina of the mesentery and the subjacent cellular sheath, and removes gently the aorta from the vena cava and from the body, or rather the cartilage of a vertebra, so as suitably to isolate it. If the patient is of a meagre habit, if the walls of the abdomen are very near the vertebral column, if the eye in short can follow the instruments to this place, a sound may, in this stage of the operation, be advantageously substituted for the finger. The ligature is passed by means of the needle of Deschamps, or by the ordinary method, and tied with a double knot; one end is cut near the artery, and the other is suffered to remain in the wound, which should be closed with a few stitches, and strips of adhesive plaster. If the ligatures of animal substance, proposed by Messrs. Physick, Lawrence, Jameson, &c., offered the same security as others, they ought in this case to be preferred, leaving the knot in the depths of the parts; experience, however, not having yet pronounced upon the merits of this kind of ligature, I do not venture at present to recommend them.

In the case of the patient operated upon, 25th June 1817, at nine o'clock in the evening, who died on the 27th, at eighteen minutes past one, Sir A. Cooper placed his ligature three quarters of an inch from the primitive iliacs. It would probably have been better to carry it above the inferior mesenteric artery, for reasons which must be obvious to every one. Before tying the

aorta, at the Exeter hospital, on the 5th July, 1829, Mr. James had attempted on the 2d of the previous month to obliterate the external iliac by the method of Brasdor, without any decided advantage. His patient died in a few hours. On opening the body it was found that the iliac artery was divided into two trunks, which fact shows why the first operation, which was followed by a diminution in the pulsations of the tumor, did not prevent them from regaining their original force a short time afterwards. The process of Mr. James was very similar to that of Sir A. Cooper.

SECTION II.

ARTERIES OF THE SUPERIOR EXTREMITY.

A. Arteries of the Hand.

Art. 1.—*Anatomical Remarks.*

The deep palmar arch, extended in the form of the segment of a circle convex towards the fingers, from the beginning of the first interosseous space to the hypothenar eminence, where it is completed by the termination of the ulnar, imbedded between the muscles and the bones of the metacarpus behind, and the flexors of the fingers or other soft parts of the palm of the hand in front, is so deeply situated as to render useless any farther study of it with reference to aneurism. The ulnar, or superficial arch, represents with tolerable exactness the direction of a curve of about fifteen lines in depth, the extremities of which fall upon the prominences of the pisiforme and the traperzium. It is covered at its origin by some fibres of the muscles of the little finger, in the middle by the palmar aponeurosis, and by the subcutaneous substratum through its whole extent; and furnishes, from its convexity, the lateral arteries of almost all the fingers. The branches of the median nerve, the tendons of the superficial and deep seated flexors, the lumbricales, and a very loose synovial membrane, separate it from the deeper arch, with which the anterior branch of the radial artery, a collateral of the thumb, and the deep branch of the cubital, open to a free communication.

Art. 2.—*Surgical Remarks.*

We often meet in the hand with wounds of the arteries, capable of becoming dangerous by hemorrhage. The hand is sometimes also, though rarely, subject to circumscribed aneurism. Guattani met with one as large as an orange in front of the thenar eminence. Becket, and F. de Hilden also mention each a similar example. If compression have proved insufficient to suspend the hemorrhage, or discuss the aneurism, the operator may, if the extremities of the wounded artery are perceptible at the bottom of the wound, imitate the practice of M. Roux, in seizing and tying them. The difficulties, however, experienced by M. Roux himself in a second operation, and by M. Manoury in another, together with the dangers of all kinds which attend incisions in the palm of the hand, are enough to prove that it would be preferable to apply the ligature upon the radial, or upon the cubital, above the wrist.

Art. 3.—*Manual.*

Nevertheless, the operator will find no difficulty in reaching the super-

ficial palmar arch, near its root, by beginning an incision upon the side of the os pisiforme, and prolonging it for about an inch forwards, and in the direction of the last metacarpal space. He will have to divide successively the skin and its cellulo-filamentous lining, a thin aponeurosis, and several fleshy fibres.

It would also be equally easy to tie the origin of the deep arch upon the back of the hand; the extremity of the radial is there at the bottom of the groove which separates the proximal extremity of the first two metacarpal bones. A fibrous lamella separates it from the tendons of the thumb, from the cephalic vein, and from the skin. The thumb and the index finger should be extended and forcibly held apart, so that the surgeon may not be hindered by the dorsal tendons of those two fingers. An oblique incision, about an inch and a half in length, is made at three lines from the cubital side of the long extensor of the thumb, and in the direction of that tendon. Beneath the skin may be perceived one of the great metacarpal veins, and one of the branches of the radial nerve. If pushing them aside is not found sufficient, they must be cut. The artery is still concealed by the aponeurosis, which ought not to be divided except upon a director. Finally, in isolating the vessel with the beak of the director, the operator must be careful not to lose sight of the vicinity of the carpo-metacarpal articulation.

B. Arteries of the Fore-arm.

Art. 1.—*Anatomical Remarks.*

In the fore-arm, the posterior interosseal artery, distributed between the two corresponding muscular layers and the anterior interosseal, accompanied by its nerve and resting upon the ligament of the same name, are both of them too small, and too deeply situated, to receive any assistance from the ligature. The radial and the cubital, then, are the only arteries to which the attention of the surgeon should be directed.

1st. In its inferior third, the radial artery runs in the groove which separates the tendons of the flexor radialis and the supinator longus, and is covered only by a single aponeurotic lamina, the subcutaneous stratum, and the skin; one or two veins accompany it, the nerve is some lines to the outside, and it lies almost immediately upon the anterior face of the radius. Its relations are also somewhat complicated. It rests upon the pronator teres or the radial portion of the flexor sublimis, upon which it is fixed by a fibrous lamina, and is covered by the internal edge of the supinator longus. It is also separated from the integuments here as well as below, by the brachial fascia and the superficial cellular lamina. Throughout its whole extent, its passage is represented by a line drawn from the middle of the elbow to the base of the styloid process, or by the outermost groove on the front of the fore-arm. It sometimes runs immediately under the skin; but more frequently it runs down upon the external surface of the radius, from the middle of its length; while in other cases its principal branch remains in front and forms almost alone the superficial palmar arch.

2d. The ulnar, covered in the upper part of its length by the whole thickness of the superficial muscular stratum, is on that account accessible to the surgeon only in the three inferior fourths of its extent, where it is found upon the flexor profundus, between the flexor sublimis and the flexor carpi ulnaris. The vein is on the outside and the nerve on the inside; that is, on the ulnar side; first an aponeurosis, then the flexor ulnaris muscle or its tendon,

and lastly a second fibrous lamina and the adipose stratum, separate it from the skin. Its direction in its two inferior thirds is traced by means of a line extending from the internal condyle of the humorus to the radial side of the pisiforme; and in its upper third, from the middle of the elbow to the junction of the middle with the superior third of the ulna. Its anomalies of position are much more frequent than those of the radial; I have often found it between the aponeurosis and the skin, sometimes in the whole and sometimes only in part of its length, and am acquainted with several individuals in whose persons it is thus placed. At other times it is found between the aponeurosis and the muscles; and in certain cases it remains for a considerable time near the axis of the limb, only approaching the ulnar nerve near the wrist.

Art. 2.—Surgical and Historical Remarks.

Aneurisms of the radial, near the wrist, may doubtless yield to compression: Tulpius cites an example; and this means certainly should be tried, as has been remarked by M. Roux, with patients who are irritable or timid; like him mentioned by Petit, of Lyons, who died of convulsions in consequence of the ligature of the radial. Doubtless, also, the greater number of hemorrhages of the hand and fore-arm may be arrested by a well-applied compression. This, however, does not invalidate the assertion that ligature is the surest and least dangerous remedy in all injuries or diseases of this nature. These are two means which it is often found advantageous to combine. For example, instead of tying at the same time both arteries of the fore-arm for a wound in the hand, which would seem to be required by the free communication established by the two palmar arches, it is sufficient to apply a ligature upon the principal trunk, and to compress the other. At the wrist, or above, if the superior extremity of the open artery is tied, it will be sufficient to compress the inferior extremity to prevent hemorrhage from the return of the blood. These directions apply also to circumscribed aneurisms. If the affection, whether traumatic or spontaneous, occurs on the dorsal branch of the ulnar artery (of which Messrs. Petit and Baretta observed an example in the hospital at Lyons), or on any other branch of the same region, the ligature, which is almost perfectly safe and easy to apply, ought to be preferred to all other means, and should be placed both above and below the disease. Unless the ligature is applied within the wound itself, it should be placed immediately above the wrist, or else in the superior third of the fore-arm.

Art. 3.—Manual.

1st. *The Radial above the Wrist.*—When the radial artery is to be tied above the wrist, the hand should be held supine, the surgeon then, standing on the cubital side, makes with a straight or convex bistoury an incision of the integuments one or two inches in extent, over the course of the artery, taking care not to proceed too deeply at first. He afterwards divides the aponeurosis upon a grooved director, so as to avoid touching the vessels with the bistoury. As the nerve is at a considerable distance, and the collateral vein is almost unimportant, it is indifferent whether the artery is raised from its internal or external side, but the operator should avoid detaching it too extensively.

2d. *Ulnar above the Wrist.*—The hand and the fore part of the arm are placed, as for the radial in a supine posture; the incision is also of the same extent and in the same direction. It is not necessary that it should descend

to the level of the radio-carpal articulation; and it should be made upon the radial edge of the flexor ulnaris muscle, or in the groove in the front of the fore-arm which lies nearest the ulnar edge. After having divided the skin, the adipose stratum, and the thin fibrous lamina which covers the tendon of the flexor ulnaris, and pushed that tendon outwards, the artery will be perceived through a second aponeurotic lamina, a little before and to the radial side of the ulnar nerve.

3d. *Radial in the superior third of the Fore-arm.*—As it is necessary to penetrate more deeply in the superior half of the fore-arm than into the inferior half, the incision must be at least two inches in length, and should be a little oblique from within outwards, so that it may not fail to pass over the line of direction of the artery. If the superficial radial vein, or the common median vein presents itself under the skin, it must be pushed aside with the director. It is better to fall some lines on the outside than on the inside of the edge of the supinator longus muscle. In the former direction the aponeurosis is not yet double, but presents only a single lamina, while in the other, that is to say, over the edge of the muscle, a primary lamina must first be divided, and the fleshy fasciculus drawn somewhat outward; a second lamina appears beneath which is cut upon the director, and the artery may then be easily taken up.

4th. *Ulnar in the superior third of the Fore-arm.*—Ligature of the cubital towards its superior third, is counted one of the most difficult operations performed upon the upper extremity. This impression doubtless proceeds from the fact, that the greater part of authors have given only vague and indefinite rules for its execution. I have never found that, when performed in the following manner the operation required greater skill than the ligature of the radial: an incision is made three or four inches in length, beginning at three fingers' breadth from the trochlea of the humerus and descending to the middle of the fore-arm, in the line above described. The aponeurosis being laid bare, the interstice between the flexor ulnaris and the flexor of the little finger is next sought for. To prevent the possibility of error, it is only necessary to draw the internal edge of the wound towards the cubital side of the member; and in returning afterwards towards the median line, the first yellow or greyish trace indicates positively the interstice required. An incision is then made in the aponeurosis upon the external edge of this line, of the same extent with that in the skin; this done, the flexor ulnaris and the flexor minimi digiti are separated from each other by means of the index finger, the handle of a scalpel, or a director; the operator will then see at the bottom of the wound a large yellow or whitish cord, which is the cubital nerve, having the artery on its radial side. In taking up the latter it is not even necessary to see it. It may be safely and surely raised by passing the beak of the sound between it and the nerve. If the disease occupies a more elevated point of the cubital artery, since that vessel changes its direction and becomes more and more difficult to discover, it will evidently be preferable to tie the brachial.

C. Arteries of the Elbow.

Art. 1.—*Anatomical Remarks.*

At the bend of the arm the humeral artery usually divides into the radial and ulnar branches; but instead of being always opposite or below the coronoid process, its bifurcation occasionally takes place in front of the articulation,

and sometimes even still higher. In descending it takes an oblique direction from within outwards, lies upon the inner portion of the brachialis anticus muscle between the biceps and the pronator teres, and lower down tends to cross in the same direction the anterior surface of the tendon of the biceps. The deep vein runs along its radial side, and the median nerve, which sometimes touches its cubital edge, is frequently separated from it by a fasciculus of the brachialis anticus muscle. A cellular sheath, more or less dense, envelopes it with the vein. It is crossed and confined by the anterior tendon of the biceps, and is farther covered by the aponeurosis of that region. It has in front, first, the trunk of the basilic vein, then the corresponding median vein, the branches of the internal cutaneous nerve, and the cellular adipose stratum, which remove it more or less from contact with the skin. When its division takes place higher than usual, the nerve generally lies between the two arterial trunks; in which case particularly the cubital is disposed to come forward under the skin.

Art. 2.—Surgical and Historical Remarks.

The bend of the arm is more subject to aneurism than any other part of the body, particularly to false and traumatic aneurisms, whether diffuse, circumscribed, or varicose. Spontaneous aneurism takes place here, as in front of all the great articulations, in consequence of violent extension as in case of the carter mentioned by Saviard. It is much more rare, however, in this part than at the ham, or even at the bend of the groin. Besides the cases reported by Fordyce, Flajani, Paletta, Lassus, Pelletan, and Roux, we can scarcely find an example of the kind in the most esteemed authors. Scarpa himself does not seem to have met with one. The bend of the arm is the favorite seat of varicose aneurism, whether simple, false, or circumscribed. I have also seen a varicose dilatation, a true hypertrophia of all the arteries of the hand and fore-arm, extending to the height of the tendon of the biceps. Formerly, when minor surgery was in the hands of barbers and persons without any notion of anatomy, it was thought that in performing the operation of phlebotomy the artery must of course be frequently wounded. Now, however, that this branch of the art is confided exclusively to young surgeons or medical students, this accident is far more rare than formerly.

To understand the different forms and various directions taken by aneurisms of the elbow, it is necessary to give the most serious attention to the situation of the aponeurosis. If the puncture take place under the superficial tendon of the biceps, the aneurismal tumor finding here an opening somewhat similar to that in the fascia lata in the inguinal region, will be able to develop itself with great rapidity in an equable manner, and may correspond by its centre to the perforation of the vessel. Above this barrier, the fibres of the aponeurosis, which are separated by small intervals and not firmly united, will at first for a time resist and mask the tumor, but eventually they will give way, and its progress will from that time cease to be impeded. If, on the contrary, the lesion is immediately behind the lamina in question, the tumor to enlarge itself must deviate from a vertical direction; will more frequently expand itself below than above, towards one of those points which have been mentioned; and will afterwards issue sometimes at a considerable distance from the place of its origin. Ligature of the brachial artery in this region is practised not only for aneurisms of the bend of the arm, but also for those which occupy the superior third of the fore-arm. At the present day it is even more frequently applied in the latter than in the former cases, since

Anel's method renders it necessary to carry the ligature upon a point more or less elevated above the elbow.

Spontaneous cures of aneurisms of the bend of the arm, or cures assisted by compression, have been so frequently seen as to have become quite a common affair. D. Pomaret, of Montpeliers, gives an account of a patient who would not submit to an operation, and who was perfectly cured by the bursting of the aneurism. Monteggia speaks of a man aged seventy-seven years, who had the artery opened in the operation of phlebotomy, and an attempt made to close the wound with a bandage. The patient was not able to bear this treatment. Several symptoms occurred to disquiet the surgeon, but they soon vanished and with them the aneurismal tumor. Galen cured an aneurism at the elbow of a young man by means of regulated compression. Genga appears to have frequently succeeded by means of the bandage commonly ascribed to Theden, White, Desault, Foubert, Scarpa, and Stoker, and quite recently the German journals have reported examples in favor of this method. The Abbe Bourdelot caused it to be generally adopted more than a century ago, by applying it with success upon his own person, for circumscribed aneurism at the elbow.

Again, the malady may proceed so slowly as scarcely to interfere with the usual avocations of the patient. An aneurism of the bend of the arm, says Saviard, "happened to a man after the operation of phlebotomy; it was of the size of a nut, and was carried by the patient for seventeen years, during the whole of which time he pursued his ordinary labor in a coal mine. Suddenly, however, the tumor increased to such a degree as to produce a considerable swelling of the arm, and it was with great difficulty that gangrene of the member was prevented." These aneurisms always sooner or later (with a few rare exceptions) come to endanger the life of the patient; the surgeon, therefore in ordinary cases, should never suffer himself to be stopped or influenced by the consideration of such cases as those above mentioned. If compression does not appear to him to be sufficient, or is not attended with marked amendment, it is his duty immediately to have recourse to the ligature.

The methods of Aetius, of Paul of Egina, and of Guillemeau were only applied to aneurism of the elbow, until Keisleyre, and the Italian surgeons ventured to apply the same mode of treatment to aneurisms of the popliteal space. And it is in this part that Anel cured an aneurismal tumor without touching it, by simply tying the artery above the seat of the disease. Mirault, of Angers, was the first amongst us who imitated him in this operation towards the commencement of the present century. Although it is generally admitted that the method of Anel is here sufficient, that of Keisleyre is still sometimes practised; in diffused aneurisms, for example, and in varicose or circumscribed aneurisms, when the sides have become extremely thin or much diseased. The reason assigned in the first case is, that in limiting the operation to ligature of the artery above the lesion, there is a possibility of a return of hemorrhage from below; in the second, that by the obliteration of the artery above, the blood is not prevented from passing from the vein by the opening of communication; in the third, that by Anel's method it is impossible when the disease has reached this stage to obtain resolution of the aneurismal sac, which it is necessary to open and empty of coagula in order to prevent gangrene, and that in all, the method of Keisleyre will preserve a greater number of anastomic branches.

These motives do not, really in any way demonstrate the absolute necessity of the ancient method in these cases. The application of a ligature above

the injury is always easy and simple, but through an opening in the sac or over the place of the wound it is sometimes more laborious and difficult. If the tumor do not contract after the operation, if it threatens to gangrene, or form an abscess, there is nothing to prevent its being treated as a purulent collection. Compression, even moderately used, will rarely fail to arrest hemorrhage, supposing it should take place after the application of a ligature above a recent traumatic aneurism. It is true that in the case of a patient operated upon by the new method at the Hotel Dieu, by M. Breschet, the advance of the aneurismal sac yielded only to the opening of the bag and the ligature of both ends of the artery, but it is not certain, from the details of the operation, that the humeral artery was embraced in the ligature at the time of the first operation. But Mr. Guthrie, a declared partizan of Keisleyre's method, reports a case which furnishes matter for reflection upon this point. A man of good constitution had the artery pricked with a lancet. It was tied above the wound. Hemorrhage re-appeared. It was tied still higher. A new incision was made. The member was amputated and the patient died. "It was necessary," says Mr. G. "to tie, not only the brachial, but even the origin of the radial and the ulnar." As to varicose aneurism, it must be acknowledged that a certain number of facts seem fully to justify exclusive resort to the old method, as recommended by Messrs. Richerand and Dupuytren. Four examples cited by M. D. in support of this opinion, may be found in Sabatier's Operative Surgery. In the first case, notwithstanding the application of the ligature by Anel's method, amputation of the member became necessary. In the second, a false anchylosis of the fingers, and other unfortunate results rendered amputation also necessary. Finally, in the third and fourth, the patient underwent a second operation in which the surgeon tied the artery above and below the wound.

Art. 3.—*Manual.*

When he has decided to tie the brachial artery at the elbow, the operator proceeds as follows:—The fore-arm is extended upon the arm, more or less removed from the trunk, and held supine. An incision is then made three inches in length, parallel to the radial or superior edge of the pronator teres muscle, commencing nearly an inch above the epitrochlea, and terminating in the middle of the bend of the arm. Beneath the skin are the superficial veins, the median basilic vein, and the branches of the cutaneous nerve which accompany it. These are held aside by an assistant with a blunt hook, or the beak of a probe bent for the purpose. Whenever any of their branches impede the operation, or cannot be conveniently displaced, they should be cut between two ligatures, or even without that precaution when they are not too voluminous. The aponeurosis is next seen, and must be divided upon the director, even when it would be possible to preserve the superficial tendon of the biceps, it is better to sacrifice it: the remainder of the operation will thus become much more easy, and a powerful cause of inflammatory strangulation will be destroyed. After having disembarrassed the artery from the lamellar and adipose cellular tissue which surrounds it; after having separated it from the deep vein or veins and from the median nerve, the operator passes between it and this latter cord the extremity of a probe, which he then causes to glide behind it so as to raise it, whilst with a nail of the other hand he hinders the veins from following it, or from lying under the point of the instrument. After this the ligature is applied, and the operation is done.

The course of the blood for a time interrupted, quietly re-establishes itself

by means of the two anastomic circles formed by the internal and external collateral branches of the brachial round the epicondyle and the epitrochlea, with the recurrent branches of the radial and the ulna. Thus it is not by any means necessary, in order to explain this phenomena (as it was for a long time believed), that the artery of the elbow should be divided into two trunks above the obliterated point.

D. The Brachial.

Art. 1.—*Anatomical Remarks.*

The humeral artery is situated in the middle of the internal bicipital channel. Its passage corresponds with an oblique line drawn from the hollow of the arm-pit to the middle of the bend of the elbow. The median nerve, which in the upper part of its course runs along the radial edge, afterwards covers the cutaneous surface, which it crosses very obliquely to take low down a position on its cubital side. Two venæ comites usually attend it, sometimes touching and even covering it, and separating it from the median nerve. The ulnar and internal cutaneous nerves which are next it above, recede from it more and more as they descend, so to reach the internal side of the fore-arm. At first it lies against the humerus, between the coraco-brachialis and the tendon of the latissimus dorsi, but soon arrives upon the brachialis anticus behind the biceps, which it accompanies to its termination. Upon attenuated subjects, the *aponeurosis* is nearly in contact with it, and doubles itself so as to envelope its trunk and that of its collateral vein, and furnishes a sheath to the median nerve and other lamellæ which unite these different organs so as to form of all a sort of common mass. The whole is covered, as elsewhere, by the common integuments; in the inferior third by the trunk of the basilic vein. Its anomalies are so frequent that every body knows them. I have sometimes seen it divided into two trunks near the axillary cavity—sometimes at some inches below—sometimes at the middle of the arm—sometimes just above the elbow—in fact, at all heights of the limb. In one subject, one of these branches divided at two inches from the epitrochlea, in in order to form the ulnar and the posterior interosseal. In another case, the latter was given off independently of the radial and ulnar. The two trunks sometimes remained side by side, as far as the fore arm; at other times they cross each other at one or more points. It is not at all extraordinary to see one, generally the ulnar, piercing the aponeurosis and running immediately under the skin; whilst the other, which then furnishes the radial and interosseal, preserves its customary relations.

Art. 2.—*Surgical and Historical Remarks.*

The brachial artery may become the seat of aneurismal affections almost indifferently, upon almost all points in its extent; it is however infinitely more disposed to them at the bend of the arm than at any other part. As nothing hinders their equable development, the tumors caused by these maladies are ordinarily regular, speedily acquire considerable size, and frequently lie with the centre over the opening of the artery.

Previously to having recourse to the ligature, it is sometimes admissible to employ compression and refrigerants; the humerus here offers a reacting surface, which is particularly favorable to the employment of these means.

M. Lisfranc mentions a patient who had four aneurisms upon the arm, the progress of which he arrested for a whole year by means of a laced sleeve. The Queen of Bavaria, and another personage of the north, were cured of aneurisms of this kind by M. Winter, with a compressive bandage. But it is upon the humeral artery that Anel's operation for aneurism is most commonly performed. There the vessel is superficial, easy to be taken up, and surrounded by healthy parts preserving their natural relations; whilst in front of the articulation, the tumor sometimes masks the seat of the perforation in such a manner as to render it very difficult to discover. The application of the ligature near the arm-pit or the elbow, provided the principal collateral can be preserved, causes a disturbance in the circulation in both cases almost the same. Nevertheless, as a grand rule, the ligature should be practised at as low a point as the situation of the malady will permit. No case, except a diffused aneurism or a still bleeding wound, appears to call for the old method in preference to the new. If the aneurism is too high, the axillary should be tied, unless it is judged better to adopt the method of Brasdor.

Art. 3.—*Manual.*

The member being placed as previously described, the operator seeks the groove at the edge of the biceps, carries the bistoury in the direction of the arterial line from above downwards for the right arm, and from below upwards for the left, and makes an incision of two or three inches through the integuments. Immediately afterwards he slips the left index finger into the wound, and endeavors to feel the median nerve, which presents a cord of considerable firmness and which may be distinguished from the artery by the pulsations of the latter; he then divides, one after the other, upon a director, the aponeurosis, and the sheath which it gives to the medio-digital nerve; tears always with the beak of the sound the cellulo fibrous sheath of the vessel, separates the artery from the veins which accompany it, and passes the ligature. This operation cannot become difficult except in consequence of some anomaly or change in the relations of the organs. The median nerve is the first cord which presents itself behind the biceps muscle; I have only once seen it under the artery, between that vessel and the brachialis anticus muscle. Whenever it is recognized, the operator may be sure that the vessels are not far off.

When the brachial is obliterated, the circulation continues below by means of the numerous muscular branches which this trunk furnishes at different points of its length, by the great collateral or external collateral, and by the anastomica magna, if this latter have not been sacrificed.

E. Axillary.

Art. 1.—*Anatomical Remarks.*

I shall call by the name of the axillary artery, only that portion of the brachial trunk which extends from the clavicle to the origin of the humeral artery. It may be considered in two points of view—from the hollow and from the anterior face of the axilla. 1st. In the first direction it is only separated from the skin by the two sorts of the median nerve, by that nerve itself, by the axillary vein, a stratum of adipose filamentous cellular tissue, becoming thicker as it approaches the apex of the axilla, by the aponeurosis, and by a second cellular stratum. The sorts of the thoracic and subscapular veins, &c.

cross it and hide it at different points, whilst the other nerves of the brachial plexus which first lie in front, soon pass behind it to gain the cubital side of the arm. Outwardly, it rests upon the tendon of the subscapular muscle and upon the humeral articulation upon the head and the neck of the humerus, and between the tendon of the teres major behind and the pectoralis minor or coraco brachialis in front. 2dly. In the other direction it is at a considerable distance from the skin, and ought to be studied above and below the pectoralis minor, which crosses it at two or three inches in front of the clavicle, producing two triangular spaces, of which the superior, which I shall call *clavi-pectoral*, limited below by the edge of the muscle, above by the clavicle, and outwardly by the coracoid process, is the more remarkable. A fibro-cellular lamina, sometimes quite dense, which I have named the *coraco-clavicular aponeurosis*, covers its plane, and separates it from the pectoralis major. Below is the vascular and nervous plexus. The vein is placed on the inside towards the breast, and the anterior root of the median nerve on the outside towards the shoulder, in such a manner that both partly cover the artery, which lies between and a little behind them. This disposition is almost invariable, and greatly facilitates the operation. At the summit of the triangle, the cephalic vein, together with those that come from the promontory of the shoulder to empty into the axillary beneath the clavicle, are obliged to cross its interior face. This is true also of one or two thoracic branches of the nervous plexus. It there furnishes the acromial artery and the principal external thoracic, before passing under the pectoralis minor muscle.

The second triangle, which is bounded by the inferior edge of the lesser pectoral muscle above, the superior fourth of the *humerus* on the outside, and the anterior edge of the axilla below, is entirely covered by the pectoralis major muscle. Here the median nerve is in front, the ulnar on the outside, the radial or musculo-spiral behind the vein, on the inside of the artery; in fact, it is completely enveloped by these organs, to which it is also united by a cellulo-fibrous sheath of considerable strength. The subscapular and external thoracic veins and sometimes the basilic, come in to add to the complexity of these numerous affinities. The lymphatic ganglions are thrown back much more towards the breast, and thus, in addition to the cellular tissue, remove it from the external surface of the serratus magnus. Finally, an adipose stratum, of greater or less thickness, the pectoralis major, a lamella rather cellular than fibrous, the subcutaneous tissue, and the skin, cover all these various objects.

Art. 2.—Surgical and Historical Remarks.

Aneurisms and wounds of the axillary artery demand the most serious attention. Although they are less frequent here than at the ham, at the groin, or at the bend of the arm, they are more so than upon any of the other part of the body. This fact is easily accounted for by the position and volume of the vessel, its relations to the articulation, and its proximity to the heart. It is subject to every species of aneurism; even varicose aneurism has been observed in the axillary by Larrey, of Toulouse, and by M. Boisseau. The pressure which aneurismal tumor here exerts upon the nerves, the veins, the ganglions, the articulation, and all the surrounding parts, renders it a malady which for a long time was the terror of surgeons, and which was believed, until the end of the last century, to be wholly beyond their art.

But Van Swieten mentions a case of a traumatic aneurism of this region, which was spontaneously cured without the loss of the limb. Mr. Samuel Cooper

also speaks of a patient at St. Bartholomew's Hospital, who recovered, without treatment, of an aneurism in the arm-pit. Sabatier caused one to disappear by the method of Valsalva and the assistance of refrigerants. Hall, too, towards the middle of the last century, and Mr. Keate, in 1801, tied the axillary artery with complete success. Amputation, then, should not be thought of in these cases; I do not know that it was indispensably necessary, even in the instance of diffused aneurism observed in 1812, by M. Debaig, at Val-de-grace.

The cures obtained by the efforts of the organization, weakening regimen, digitalis, purgatives, or cold topical application, appear to me to have been too few and too much accidental to be counted upon in the way of encouragement. The operation is incomparably more certain, and ought always to be practised when possible. White performed it unsuccessfully: the limb was invaded by gangrene, but the nervous plexus had been comprised in the ligature. Desault was equally unfortunate, but he had also included in the first ligature the whole of the brachial plexus. On another occasion, he was not able to arrest the progress of a hemorrhage, which was quickly mortal. In the case reported by Pelletan, the whole thickness of the arm-pit was traversed with a needle, and the artery was not seized. Another attempt of Desault, which proved equally unsuccessful, is also on record. M. Roux says that a patient died at the Beaujon Hospital from the consequences of a similar attempt. M. Delpech, who thought it necessary to cut across the pectoralis minor, and to raise the whole of the axillary plexus with the fore-finger of the left hand bent into a hook in order the better to isolate the artery, was also unsuccessful in 1814. These cases, however, do not prove any thing against the operation; the cause of failure was the improper mode of procedure adopted, or else the untoward circumstances in which the patients were placed.

To the two examples of success mentioned by Hall and Keate, may be added a third, by M. Maunoir, and two others which have been communicated by Messrs. Chamberlayne and Monteith.

Art. 3.—*Manual.*

1. *Process of M. Lisfranc.*—If a free space remain above the tumor, or if the operation is for a simple wound in the upper part of the arm-pit, it is better, according to Messrs. Lisfranc, Hall, and Maunoir, to search for the artery from the hollow of the arm-pit than to divide the anterior wall of that space.

The patient being placed upon his back, and the limb removed as much as possible from the trunk, an incision is made of three inches in extent parallel to the vessels, and a little nearer to the anterior than to the posterior border of the axilla; the skin, the cellular stratum, and the filamentous aponeurosis present themselves successively, as in the arm. The remainder of the operation is performed with the director. With its beak the surgeon pushes the median nerve forwards and outwards; he then directs it behind the artery in order to separate it from the ulnar and radial nerves, and raises it a little in order to pass between it and the vein, which latter he tries with the nail of the index, or of the thumb of the other hand, to push backwards and inwards.

The patient spoken of by J. Bell had received a stroke from a scythe, and had fallen into a state of syncope. Hall consequently found it sufficient to tie the upper portion of the artery. M. Maunoir's patient had received a sabre-stroke; the wound was simply enlarged. M. M. applied a thread above and below the wound in the vessel. It is evident that in actual aneurism, the opening of the sac would here be very dangerous; too dangerous in fact to be preferred in any case. When it is not possible to adopt the mode of pro-

cedure above mentioned, should we penetrate by the front of the arm-pit? Would it not be better, more prudent, to proceed to search for the subclavian behind the clavicle, as was practised with success by Mr. Gibbs, or, according to the method of Brasdor, to apply the ligature below the tumor? Time and experience will doubtless solve these questions. I shall only say, in the meantime, that if the cyst is small enough and high enough to permit the application of the ligature between its inferior extremity and the origin of the circumflex and subscapular arteries, the operator will have every possible chance of success in conforming to the method of Brasdor; and that in contrary cases, it is much to be feared that the morbid affection of the arterial coats will be prolonged to the clavicle, in such a manner as to render the ligature useless upon any point of the axillary trunk. Should the surgeon, however, notwithstanding the advice here given, resolve upon practising the ligature through the front wall of the axilla, he will find processes enough by which to effect his purpose.

2. *Process of Desault.*—M. Roux, after Desault, recommends to incise the soft parts on the inside of the *coraco deltoid* line; afterwards to divide the pectoralis major upon the grooved director, also the pectoralis minor if necessary, to expose the whole of the brachial plexus, and to take it up between the thumb and fore-finger of the left hand, in order carefully to isolate it from the artery as low down as possible. It is not absolutely indispensable to resort to this mode of procedure, except in operating by opening the aneurismal sac, and it is probably by inadvertence that it has recently obtained the credit of being the best method in other cases. If it were indeed prudent or possible to tie the axillary artery above the tumor at this height, it ought to be done from the hollow of the arm-pit, and not through the pectoralis muscle. Although adopted by M. Delpech, in 1814, and since practised by M. Roux, I cannot consider this method otherwise than as a last resource.

3. *Process of Mr. Keate.*—The incision of Mr. Keate was oblique downwards and outwards. It comprised a part of the pectoralis major without dividing it entirely, but a first ligature was applied too low; it was necessary to place a second very near the clavicle. This would probably not have happened if, previously to passing a curved needle into the bottom of the wound, Mr. Keate had taken the precaution to isolate the artery with the grooved probe.

4. *Process of Mr. Chamberlayne.*—The conduct of Mr. Chamberlayne was more regular and rational. He thought proper at first to make a transverse incision of three inches in length in front of the clavicle; he afterwards made a second of the same extent parallel to the cellular line which separates the pectoralis major from the deltoid, turned down the triangular flap formed by that complex incision, and the artery, which he recognized by its pulsations, was then exposed: an eyed probe served to pass the ligature. This operation was performed on the 17th of January, and by the 22d of February the cure was complete.

5. *Process of Mr. Hodgson.*—Mr. Hodgson rejects the double incision. According to him and Mr. S. Cooper, the best method is to describe a semilunar flap with its convexity downwards, the extremities of which, separated by an interval of three inches, correspond, the one with the clavicle near the sternum, and the other with the acromion process. After having raised this flap, which comprises the whole thickness of the pectoralis major, the upper triangle of the arm-pit will be found exposed, and the artery may be easily isolated and taken up between the clavicle and pectoralis minor. Messrs. Hodgson and Chamberlayne, however, may be reproached with having sacri-

ficed to no purpose, a great portion of the pectoral and deltoid muscles. So that in France, a mode of procedure is now particularly recommended, which is very similar to that described by Mr. C. Bell, and differs very little from that of Mr. Keate.

6. *Ordinary Method.*—The member is at first slightly removed from the trunk, the shoulder depressed a little backwards. The surgeon, then standing between the breast and the arm, begins his incision at two fingers' breadth to the outside of the *sterno clavicular* articulation, and prolongs it to a point beneath the coracoid process, in the direction of the fibres of the pectoralis major, taking care to stop at the distance of some lines from the interstice between the pectoralis and the deltoides. If any little artery present itself under the skin, the ligature is immediately applied to it; the fleshy fibres are gradually separated rather than divided with the bistoury, a very distinct yellow stratum indicates that the operator has passed through the muscle, the fibres of which are then relaxed by lowering the member a little, in order more easily to separate or cause to be separated the lips of the wound. If there be the slightest danger of wounding the vessels, the director or probe should here be substituted for the cutting instrument; the operator tears with its beak the adipose and cellular stratum and the coraco-clavicular aponeurosis, whilst the left index finger, bent into a hook, depresses with considerable force the upper edge of the pectoralis minor. The operator will soon distinguish the vein, which may be known by its size and bluish color, or the first division of the brachial plexus of nerves. In seeking for the artery between and behind these two cords, the director is guided upon the external side of the vein, which it is necessary to push a little towards the thorax. The instrument is then made to penetrate by a to and fro movement to a depth of from four to six lines, in such a way that in raising it again from rear to front and from within outwards, it may not fail to bring up the arterial trunk, from which the operator removes the nerve either with the finger nail or the beak of another director.

By these precautions, the secondary vessels and the nervous cords upon a dead subject at least, are easily avoided, and the artery with certainty exposed. By placing the ligature immediately under the cephalic vein, the operator is almost sure to embrace the axillary between the acromials, which are left above, and the external thoracics which pass below. The supplementary branches which maintain the circulation in the member after this operation, are the acromial, the subscapular, the transverse cervical, the internal mammary, and some others of minor importance, all of which form anastomoses with the circumflex, the common scapular, and the external mammary.

F. Subclavian.

Art. 1.—*Anatomical Remarks.*

Several authors have described the axillary artery as formed of two portions; one, that which I have just examined, situated below the clavicle, the other placed between that bone and the scaleni muscles. Nothing can justify such an abuse of anatomical language; the brachial trunk ought not to take the name of axillary until it enters the arm-pit; until then it is the subclavian artery.

1st. On the inside of the scalenus, the subclavian extremely short on the right hand, on account of its origin from the innominata, lies by its posterior

surface in contact with some filaments of the great sympathetic; furnishes the vertebral, and is separated from the triangular space between the longus colli and the anterior scalenus only by cellular tissue, some lymphatic ganglions, and the beginning of the recurrent nerve. The pneumo-gastric, the phrenic, and that branch of the trisplanchnic which connects the second with the third cervical ganglion, cross its anterior surface, which is afterwards covered by the sterno-thyroideus and sterno-hyoideus muscles, several cellural laminæ, the internal edge of the sterno-mastoideus, the aponeurotical strata of the neck, and, lastly, by the common integument. Below it is embraced by the recurrent nerve, and its concavity is only removed from the lungs by the *pleura*, or a little cellular tissue. In this short passage it gives off the internal *mammary*, the thyroid, the transverse cervical, the ascending cervical, the profound cervical, and the superior intercostal. On the left side it extends almost vertically from the arch of the aorta to the edge of the first rib, receding by degrees from the corresponding carotid. The pneumo-gastric nerve descends upon its internal side; the recurrent does not cross it behind, because it is not until after that nerve has turned around the arch of the aorta that it reascends towards the trachea. The thoracic duct approaches very near its posterior surface, and commonly hooks around it above to empty into the subclavian vein. This vein, which is separated from the artery by a considerable interval, crosses it at some distance, whilst on the right it is principally covered by the termination of the internal jugular.

2d. After it has become horizontal, the subclavian holds the same relations on either side, and lies immediately on the first rib. The inferior attachment of the anterior scalenus separates it from the vein, and this from the sternal portion of the sterno-mastoideus muscle; all the nerves of the brachial plexus are above and behind, so as to form, by prolonging themselves upon the anterior surface of the posterior *scalenus*, a sort of lattice-work, of which the artery is the lowest bar.

3d. On the outside of the scalenus it corresponds to the hollow above the clavicle, rests upon the first intercostal space, the second rib, and the first *fasciculus* of the serratus magnus muscle. The vein approaches and covers it, descending a little towards the clavicle; receives there the subscapular, the external jugular, and sometimes the acromial vein, from which results in certain cases a somewhat complicated plexus. Its superior side is accompanied by the united cords of the last cervical pair and the first dorsal; a little farther off by the other branches of the brachial plexus, which soon pass behind, so that it is found constantly in the triangular space, bounded by the omo-hyoideus on the outside, the clavicle below, and the anterior scalenus muscle on the inside. In returning towards the skin, the operator will meet with lamellar and adipose and filamentous masses, with lympathatic ganglions, small veins, the supra-scapular and posterior cervical arteries, many nervous branches of the cervical plexus, a very irregular aponeurosis, and, near the sternum, the external root of the sterno-mastoideus muscle, the superficial veins, and some scattered fibres of the platysma myoides.

Anomaly.—I shall add to the above details, already perhaps too minute, that the vein has been seen with the artery between the scaleni muscles; and again, that the artery has passed to the place of the vein, and that I have myself witnessed both these anomalies. When the small scalenus muscle exists, it may, as has been remarked by M. Robert, in attaching itself to the rib, separate the two inferior cervical nerves from the superior branches, and incline them forwards and towards the vessels; at other times the artery may be completely isolated by it from all the nerves. It is possible, also,

that the vein may be more than usually high above the clavicle—may be divided into two trunks, as observed by Morgagni, and may entirely hide the artery, which is sometimes, though rarely, environed on all sides by the brachial nerves. The occasional presence of a small muscle fixed by its two extremities upon the clavicle, the attachment of the sterno-hyoideus to the inside of the sterno-mastoideus, the insertion of a second root or the inferior border of the omo-hyoideus muscle in the clavicle, are also anomalies of which the surgeon ought not to be unapprised.

Art. 2.—Surgical Remarks.

The subclavian, sheltered as it is by the clavicle, partly enclosed within the breast, protected at least by the sides of this cavity, is but little exposed to the influence of external agents; removed also from the alternations of flexion and extension to which the axillary and popliteal arteries are subjected, it is thus free from one of the most frequent causes of spontaneous aneurism. Nevertheless, it is not entirely exempt, but is sometimes affected by the maladies to which the other arteries are subject. M. Larrey relates two examples of its being wounded by sharp weapons. In a third case the wound was followed by a varicose aneurism.

In all cases, it is less for lesions of itself than for those of the axillary, that ligature is applied upon the subclavian artery. When an aneurismal tumor in fact develops itself in the supra-clavicular hollow, however small may be its volume, it soon becomes impossible to place a thread between it and the heart, upon the trunk which it affects. If an aneurism at the hollow of the arm-pit, on the contrary, enlarge so as to raise the shoulder, the ligature is applied above the clavicle. Aneurisms which might be cured by the ligature of the subclavian, sometimes disappear spontaneously, as in the case published by M. Bernardin. The method of Valsalva, refrigerants, &c., would also, without doubt, occasionally arrest the progress of the malady. M. Richarme, in his thesis, cites an example of cure obtained by such means. As it is dangerous, however, to permit the tumor to increase in size, and as the results of the above resources are always problematical, it is most advisable to operate as speedily as possible.

The ancient method is not here applicable. If it is not possible to apply the method of Anel, that of Brasdor is the only one which can supply its place; and the operation is then not ligature of the subclavian, but ligature of the axillary for aneurism of the subclavian.

M. Dupuytren was the first who performed this operation upon a living subject. The patient it is true died at the expiration of nine days (20th July, 1822), but instead of increasing as might have been feared, the tumor was sensibly diminished in size, and lost in a great measure its pulsation; in short, numerous bleedings and a hemorrhage by a supplementary branch (which was at first supposed to proceed from a wound of the principal artery), seem much more than the operation itself to have been the cause of death. It must be confessed however, that the axillary offers fewer facilities than any other artery for the practice of the method in question. The numerous branches which arise from it are so many channels by which the blood will continue to circulate, and will hinder the resolution of the aneurism, unless they have been previously obliterated by the accumulation of fibrin or by the progress of the tumor. The branches also which are given off by the subclavian artery to the inside of the scalenus, will, wherever the malady reaches, thus far constitute an equally powerful obstacle to the success of this mode of

operation. Yet as it is possible to apply the ligature very near the cyst, and internal concretions may have diminished, or even completely obstructed the calibre of these arteries, and as the last resistance to the course of the blood suffices to determine its coagulation in the morbid sac, I believe that it would be perfectly justifiable to repeat the operation performed by M. Dupuytren.

Art. 3.—Manual.

Ligature of the subclavian artery, according to the principles of Anel, has been practised upon three different points of its length, viz. within the scaleni, between the scaleni, and without those muscles.

1. *Process of Mr. Colles.*—Colles is the only individual to my knowledge who has ventured to expose and tie this artery between the trachea and the anterior scalenus muscle. Great difficulty was experienced in passing the thread round the artery, and it was thought that the pleura had been slightly wounded. Before fastening the thread the respiration became very laborious, and the patient complained of a sense of oppression at the heart. These symptoms became so serious that it was not deemed advisable to tighten the ligature until the fourth day. The patient found himself very well until the ninth day, when he again experienced a feeling of strangulation and great pain in the cardiac region; he then became delirious, and expired in about nine hours from the commencement of these symptoms. On opening the body, the *aorta* was found to be diseased as well as the whole extent of the subclavian artery.

2. *Another Process.*—In order to reach this point of the arterial trunk (if it is not thought advisable to imitate the process of Mr. King*), the operator should cut across upon the director the clavicular portion of the sterno-mastoideus muscle, depress the internal jugular vein towards the trachea, the subclavian vein downwards and forwards upon the clavicle, and push aside the carotid artery, and the phrenic and pnemuo-gastric nerves. On the left the operation is rendered more formidable by apprehensions of injury to the thoracic duct, as well as by the necessity of penetrating much more deeply.

But it is not impossible to place the ligature between the origins of the mammary and vertebral arteries, &c., and the heart; whilst on the right, the neighbourhood of the innominata would render such an attempt very dangerous. In every way, ligature of the subclavian artery between the scaleni and the trachea must prove difficult and formidable. It ought not even to be practised between these muscles, unless the state of the parts should be such as to render it impossible to operate on the outside. Not that it is extremely difficult, or that it would be surely unsuccessful, but because the advantages which it promises may be otherwise and more easily obtained, and because the section of the scalenus, which is in itself a disadvantage, also exposes the operator to the danger of wounding the internal jugular vein, or the subclavian itself, as well as the two respiratory nerves.

3. *Process of M. Dupuytren.*—The following is the method recommended by M. Dupuytren, who is said to have practised it several times with success, particularly in 1819:—A transverse incision is made at the base of the neck, from the anterior edge of the trapezius muscle to the external edge of the sterno-mastoideus, and is even a little prolonged upon the external surface of the latter. Having found the anterior scalenus, the operator directs between

* See further on Innominata.

its posterior side and the artery the extremity of a grooved director, upon which he divides its fibres. By the performance of this single section, the vessel is exposed and completely isolated. The posterior scalenus muscle serves as a guide to the needle-probe which bears the ligature.

4. *Process of Mr. Ramsden.*—The subclavian artery ought to be, and most commonly has been tied in the *omo-clavicular* triangle, or on the outside of the scaleni muscles. Mr. Ramsden, who was the first to perform the operation in a regular manner, proceeded as follows:—He in the first place made a horizontal incision an inch and a half long, just above the clavicle; then another incision two inches in length, parallel with the external edge of the sterno-mastoideus muscle, and meeting the extremity of the first. After having lowered the shoulder, Mr. Ramsden continued the dissection of the tissues so as to expose the edge of the anterior scalenus. The artery was then easily found; having isolated it with the nail, he endeavored to pass the ligature around it. Numerous difficulties presented themselves. It became necessary to make use of several instruments, and it was not until after multiplied attempts, that he was at last able to finish the operation. The patient died on the sixth day (9th or 10th November). Some time previously, Sir A. Cooper had attempted, but in vain, to take up the artery; he took up a nerve instead of it, and the patient died shortly afterwards of hemorrhage. In the month of April or May, a woman of about sixty years of age was admitted into the Hotel Dieu, at Paris, with an enormous aneurism in the axilla. One of the surgeons of the establishment was of opinion that ligature of the subclavian ought to be, and might be practised; the other was of the opposite opinion, and the patient died in a few days without having undergone an operation. This circumstance however occurred some time after the attempt of Messrs. Cooper and Ramsden, so that the merit of priority in this idea remains with the English practitioners.

A patient, very aged and feeble, operated upon by Mr. W. Blizard, in 1811, died on the fourth or fifth day. A similar result was experienced by M. Galtie, at Montpeliers, in 1814. Messrs. T. Blizard and Colles were equally unsuccessful in 1815; but complete success crowned the efforts of Mr. Post, in 1817, and afterwards those of Messrs. Dupuytren, Liston, Bullen, Green, Gibbs, Key, Roux, Langenbeck, Mott, Porter, &c.

5. *Process of Mr. T. Blizard.*—The modes of operation adopted by the above gentlemen, differed very little from each other. Mr. T. Blizard made an incision three inches in length, parallel with the external jugular vein at the bottom of the neck, and towards the acromion. Mr. Post divided the tissues in the direction of a line slightly oblique in reference to the clavicle, and beginning at the external edge of the sterno-mastoideus. Mr. Porter made a horizontal incision above the clavicle, then a vertical incision on the outside of the sterno-mastoideus muscle, and turned backwards the triangular flap thus formed. M. Dubled, on the contrary, recommends that the incision be made in an oblique direction downwards and inwards, so that it may fall near the sterno-clavicular articulation. According to Mr. Hodgson the incision should be exactly transverse; and his method certainly offers more advantages than any other. I do not think that the proposal of a member of the Surgical Academy, to include in the same ligature both the artery and the clavicle, has ever been renewed; and I am at a loss to conceive what reasons could induce M. Cruveilhier to say, in his course of anatomical studies, that it would be useful to saw that bone in order with greater security to tie the *subclavian.*

6. *Ordinary Process.*—The patient should be placed upon his back with

the breast a little elevated; he is made to turn the head and neck towards the sound side, while an assistant depresses the shoulder as far as the aneurism will permit, removing at the same time the arm from the trunk. The integuments are then cut in a transverse direction, at an inch above the clavicle, from the external edge of the sterno-mastoid muscle to the inner border of the trapezius. The operator then divides in the same direction the cellular tissue, the fibres of the platysma myoides, and the external jugular itself (after having tied it above and below the point of division), if there be no possibility of avoiding it by holding it aside by means of a blunt hook; he afterwards divides the aponeurosis, and with the fore-finger will then be able to distinguish the edge of the scalenus immediately beneath, and within the sterno-mastoideus. After having removed the cellular tissue, the lamellæ, the filaments, and the ganglions, from the bottom of the wound, with the end of the director or a good dissecting forceps, the finger is carried towards the root of the scalenus to find the tubercle of the first rib. This tubercle is here a sure guide; so much so, that if without leaving it the pulp of the fore-finger is turned a little outwards and backwards, it will almost invariably feel the vessel. When the vessel has once been found, the eye is no longer necessary. The nail applied against its posterior and external side, serves as a conductor to the bent probe or needle. By directing the beak of one of these instruments backwards and a little outwards, it is soon properly placed under the artery. The operator then, in order to hold the artery and prevent it from altering its position, places his finger between it and the first division of the brachial plexus of nerves.

When the shoulder is not too much deformed or elevated by the tumor, or can be depressed without inconvenience, any surgeon who has a little practical knowledge of anatomy may apply the ligature without the difficulty which is generally supposed to attend the operation. The section of the omo-hyoid muscle, proposed by some surgeons, and that of the sterno-mastoid, still practised by Mr. Mayo, are utterly useless. The action of the director, which ought to be preferred after the division of the aponeurosis, enables the operator to avoid injuring the plexus formed by the confluence of the little veins of the shoulder and the neck when they arrive at the subclavian. To avoid injuring the latter it is sufficient to carry the extremity of the conductor beneath it and next the *scalenus*, before bringing the instrument backwards to hook up the artery. Finally, as this vessel in the normal conformation is invariably the first movable cord which presents itself under the finger after leaving the tubercle of the first rib, and as the nerves are distinguished from it by their roundness and firmness, it is almost impossible that the operator can commit an error.

Results of the Operation.—Mortification of the member, which appears so much to be apprehended after the obliteration of the subclavian, seldom takes place. A sense of suffocation, delirium, and symptoms of affection of the cerebrum, of the heart, and its envelope, were observed in the patients of Messrs. Ramsden, Colles, Blizard, Mayo, Gibbs, &c. After death traces of pericarditis were discovered; the aorta and the heart were also diseased, but there was no appearance of gangrene. In some cases the circulation reestablishes itself with remarkable rapidity; pulsation reappeared in the radial and cubital arteries of Mr. Roux's patient the morning after the operation. The blood is brought back into the axillary or the brachial by the anastomoses of the internal mammary with the thoracics, and of the acromial and the common scapular with the posterior cervical and the supra-scapular. If the ligature is applied to the inside of the scaleni, above the vertebral and mam-

mary arteries, the fluids can only reach the limb of the diseased side by the communication of its vessels with those of the healthy side.

Wardrop tied the subclavian artery upon the plan of Brasdor, for an aneurism of the innominata. The corresponding carotid artery, which had been previously obliterated by the tumor, soon became pervious again. The operation appeared at first to be completely successful; but after a few days the aneurism made renewed advances, and the patient (Madame Desmarest) sank on the 13th Sept. 1829. I shall revert to this fact in another place, and shall content myself at present with remarking, that the best method of treating an injury or disease of the subclavian is to place a ligature upon the artery immediately below rather than above the clavicle.

SECTION III.

ARTERIES OF THE HEAD.

There is hardly a branch of any importance, whether upon the face or upon the cranium, but is subject to injury by external agents, or may become the seat of one of these spontaneous aneurisms which are characterised as mixed or true. Paletta cites one example, and Scarpa two, of aneurism of the temporal artery. Mr. Green has lately made known a fourth. Klaving speaks of one which occupied the left posterior auricular. The subject was a young man, twenty-five years of age. Dehaen witnessed a similar aneurism upon the dorsal artery of the nose. M. Godichon, of Versailles, saw a pediculated aneurismal tumor upon the forehead, more than an inch in thickness; he also observed another in front of the right tuber-parietale. The Leipsic transactions contain an observation of aneurism of the frontal artery. M. Gaste and M. Merat, speak of aneurism at the temple. M. Gama cured one which was seated near the commissure of the lips. M. Begin cites another which was seated upon the middle *meningeal*, and which caused the death of the patient after having perforated the temporal fossa. M. Krimer reports a similar fact. Pelletan mentions an aneurismal or erectile tumor on the eyelid—the patient a boy; also another upon the conjunctiva of a second subject; and a third upon the upper part of the forehead. He has seen also, in two different cases, almost all the branches of the occipital or temporal, and even the external carotid, dilated and in a state of hypertrophia, as in varicose aneurism. The palatine artery itself is not exempt from these aneurismal dilatations, as has been proved by an observation of M. Delabarre. As to the arteries within the cranium, they are, though less frequently, subject to the same maladies as those of the exterior. Examples of varicose aneurism, or of aneurism by anastomosis, occurring about the globe of the eye, have been published by Messrs. Wardrop, Travers, Arendt, &c. Sir A. Cooper observed a small aneurismal tumor upon the central artery of the retina. M. Serres describes another, as large as a nut, which was attached to the basilary, and Mr. Hodgson reports a case in which a small sac, formed by the anterior cerebral artery, was completely filled with a solid coagulum, which did not extend into the cavity of the vessel. But in cases of this kind one of two things is always true; either the aneurism is completely enclosed in the cranium so that nothing can indicate its presence and the resources of surgical skill are of course of no avail, or the malady displays itself upon the exterior; and if compression is not found to be sufficient, and the opening of the sac is not to be attempted, although once successfully performed by M. Cisset, upon the

occipital artery, ligature of the carotid is ordinarily preferred to that of the artery which is more particularly affected. There is scarcely any exception at the present day in this respect, unless it be for the trunk of the facial and temporal, or unless it should be possible to act upon the injured part itself.

A. Temporal.

The temporal artery is easily found at three lines in front of the ear, a little above and upon a level with the zygomatic arch. An incision of an inch in length is enough to conduct to it, and it is found enveloped in the deep laminæ of the subcutaneous cellular stratum.

B. Facial.

It would not be difficult to expose the facial at the place where it begins its course over the inferior maxilla. By cutting the skin with caution, upon the edge of that bone and in a horizontal direction, from the anterior edge of the masseter to the edge of the depressor anguli oris, it is immediately exposed. It may also be reached by dividing the parts which cover it, to the extent of an inch or an inch and a half, obliquely from above downwards and backwards, close to the masseter muscle; its satellite vein is the only organ which requires care, and even this might be wounded or compressed in the ligature without producing any serious inconvenience.

The occipital should be sought for in the neck.

SECTION IV.

ARTERIES OF THE NECK.

A. Primitive Carotid.

Art. 1.—*Anatomical Remarks.*

After leaving the breast, the carotid artery soon places itself upon the side of the passages of respiration and deglutition, where it remains until its bifurcation, which generally occurs opposite the thyro-hyoidean interstice. The internal jugular vein is joined to its external face, and in the living subject even partly hides its anterior surface. On the inside, some elastic and resisting cellular tissue and branches of the recurrent nerve and of the inferior thyroid artery, separate it from the larynx, from the trachea, and from the œsophagus. The thyroid artery below the cardiac branches of the pneumogastric nerve, and the internal divisions of the great sympathetic, cross more or less obliquely its posterior surface, the external side of which is also accompanied throughout its whole extent by the trisplanchnic and pneumo-gastric trunks. A yellow sheath, very solid and difficult to tear, incloses it with the vein, the nervous cords, and the descending branch of the hypoglossal nerve, which usually follows down its anterior and external face. This artery lies upon the forepart of the cervical vertebræ, from which it is separated by the longus colli and the rectus anticus major, and it is covered on the outside and near its root by the sterno-mastoid muscle, which soon removes from it so as to leave it uncovered on its internal side; and on the inside by the external edge of the sterno-hyoid and sterno-thyroid muscles, then by the corresponding lobe of the thyroid gland and the veins (sometimes of considerable size), which come from the face and neck to pour their contents into the internal

jugular. It is, moreover, divided as it were into two portions by the omo-hyoid muscle, towards the middle of the sub-hyoid region. This small muscle, in fact, forms of the side of the neck two very regular triangular spaces, by its passage from the posterior surface of the sterno-mastoid to the os-hyoides. In the inferior, or *omo-tracheal*, limited by the trachea, the clavicle, and the muscle in question, the artery hidden by the internal root of the sterno-mastoidean has no very complex relations, although it is very deeply situated; in the other, which is bounded by the edge of the sterno-mastoid on the outside, the transverse line which limits the sub-hyoid region above and the omo-hyoid muscle below, it is much more superficial. But there a plexus of veins frequently covers its anterior surface. The right carotid, which is shorter as is well known than the left, on account of its origin from the innominata, and which is also sensibly nearer the median line and more superficial because of the trachea which pushes it forwards near the sternum, is almost as easy to reach in the *omo-tracheal* space as in the omo-hyoid triangle.

Anomalies.—Among the varieties presented by the carotid arteries, are some, the possibility of which ought never to be lost sight of by the surgeon. That of the right side many come directly from the aorta. At other times, the innominata rises higher than usual, of which Mr. Harrison cites an instance; and it is sometimes as much abridged in length. Zagorsky has seen the left carotid and subclavian originating by a common trunk; at the right they arose separately from the aorta. I have myself seen, as well as Messrs. A. Monro, Scarpa, A. Burns, Goodman, Meckel, &c., both carotids proceed from the innominata, and in other cases given off by a common trunk which came from the aorta distinct from the subclavian arteries. But it is rare to see them separate into the internal and external carotids in the inferior part of the neck, as has been observed by Burns and others. An instance of this variety was observed last winter, in the anatomical rooms of the Jefferson Medical College in Philadelphia. M. Langenbeck saw the primitive carotid divided into the internal carotid and superior thyroid, without furnishing an external carotid; and Burns cites examples of the carotid trunk bifurcating on a level with the angle of the jaw.

Art. 2.—Surgical and Historical Remarks.

Aneurisms.—The primitive carotid has presented examples of every species of aneurism. It is but too common to see it injured by penetrating or cutting instruments, and giving passage to hemorrhage which promptly becomes mortal. Sometimes, however, the wound merely occasions an aneurism at first diffused, but afterwards circumscribed. Harder relates a case of this kind where the carotid had been wounded by the point of a sword! at other times aneurism is produced by violent motions of the head. Rumler saw this occur upon a man, who in attempting to lift a heavy burden, forcibly held back his head. Scarpa speaks of a similiar fact; the subject, who was a soldier, had been precipitated from the walls of Mantua, and experienced a violent twisting of the neck. Aneurism of the carotid may also develop itself without any apparent cause, as it has been observed by Scarpa, and proved by numerous modern examples. Messrs. Larrey and Desparanches, of Blois, have witnessed varicose aneurism at the carotid. Lesions of arteries so voluminous, the only ones which supply the exterior of the head and the greater part of the encephalon, naturally produced considerable alarm in the minds of surgeons from the time when it became known that, in order to effect a cure, it was necessary to obliterate the injured vessel.

Galen and Valsalva, it is true, had previously ascertained that ligature of the carotid arteries of dogs was not dangerous; but they were far from thinking of the performance of such an operation upon a human subject. To dissipate the doubts of the faculty upon this point, other facts were necessary. In the case of a man, who died seven years after the cure of an aneurism of the neck, M. Petit found the right carotid completely obliterated; Haller, in dissecting the body of a female, observed a similar state of the left carotid; Baillie found one of the carotids entirely closed, and the other considerably contracted. Pelletan and Sir A. Cooper relate each a similiar case; and if Koberwin may be believed, M. Jadelot saw both arteries obliterated on the same subject. These examples, added to those which have been observed of late years, particularly one which came under my own observation last winter at the dissections of the practical school, prove two things: first, that one of the carotid arteries, and even both, may be completely closed without producing death, and without cutting off the supply of blood from the brain: secondly, that aneurism of the carotids is not always beyond the resources of the organism, but that if abandoned to itself, it will in certain cases spontaneously disappear. But it is absurd to attempt the cure of aneurism of these arteries (excepting by the method of Valsalva or refrigerants, as used with some success in our own time, by M. Larrey), without renouncing the old method. It seems to be impossible to establish at the neck a sufficient degree of compression to allow the opening of the sac with perfect safety. The surgeons of La Charite, who, according to Harder, had the temerity to adopt this method, saw their patient die under their hands. According to Hebeinstreet, cited by S. Cooper, the carotid had already been tied with success for a wound which had occurred during the extirpation of a scirrhous tumor from the neck; also by Abernethy, with equal success, for a traumatic lesion of the external and internal carotids. In 1803, Mr. Fleming was equally fortunate with a mariner who had attempted suicide. The journal of Sedillot contains a fourth example of this operation performed for a wound in the neck: the patient died on the 9th day. Mr. Brown makes known a fifth, which was followed by cure. Mr. Collier furnishes a sixth, authenticated by Mr. S. Cooper; and the treatise of Mr. Hodgson contains a seventh. Anel, V. Horne, and M. Larrey, also each cite an example of wounds of the carotid, cured by simple compression.* In November, 1805, an aneurism of the carotid was treated for the first time by the method of Anel. The patient died on the twentieth day. Sir A. Cooper again had recourse to this method in the month of June 1808, and on that occasion with complete success. In the September following, a patient operated upon in the same way by Mr. Cline, at St. Thomas's Hospital, died on the fourth day. It was not until this time that the surgeons of Paris became acquainted with the attempts which had been made in London, and learned that in the year 1804 M. Dubois had prepared every thing for a similiar attempt, which, however, could not be made, in consequence of the patient having expired the evening preceding the day appointed for the operation. In our own time it has been practised by a great number of surgeons, sometimes with and sometimes without success, either for the purpose of permitting the amputation of the *maxilla*, or the extirpation of the parotid or of cancerous or fungous tumors, as in the cases of Messrs. Lisfranc, Gensoul, Walther, Fricke, M'Clellan, &c.; to cure erectile tumors, or fungous hematodes of the eye, as it has been successfully done by Messrs. Travers, Dalrymple, Arendt, &c.; for simple wounds of the face or neck, as by Messrs. Langenbeck,

* Was the carotid really the seat of the disease?

Daffin, Lisco, &c.; or finally, for aneurisms, properly so called, of the carotid or its branches. Mr. Pattison practised it with complete success in 1821, for an aneurism by anastomosis, or an erectile tumor of the zygomatic fossa, upon a subject of about nineteen years of age. The infant aged six weeks, upon whom Mr. Wardrop performed the operation for a fungous ulcer of the cheek died on the fourteenth day. In Mr. Roux's patient, the fungus was considerably diminished in the orbit, and reduced to the part which existed in the temporal fossa. M. Dupuytren's patient derived no benefit from this operation, which was performed for an erectile tumor in the concha. M. Willaume was equally unsuccessful with a subject afflicted with fungous hematodes of the left temple. Mr. Massey, who tied successively the two primitive carotids for an enormous bloody tumor of the vertex, obtained only an incomplete reduction of the fungus, and was obliged eventually to have recourse to extirpation. In the case of an infant laboring under a similar affection of the face, Dr. M'Clellan, who is said to have performed the operation four times in one year, obtained some advantage. Ligature of the carotid has been successful in forty out of sixty cases which have been published. It ought, therefore, to be admitted among the number of the most important acquisitions to the surgery of the present age. It has even been practised for mere pains in the face, but the operator in this case acknowledges, in the supplementary journal, that the sufferings of his patient were not alleviated by the operation.

Art. 3.—*Manual.*

Ligature of the carotid trunk is usually an easy operation, but practitioners differ a little as to the best manner of performing it.

1. *Ordinary Process.*—The patient should be placed upon his back, with the breast a little elevated, the neck moderately extended, and the face inclined towards the unaffected side. Standing on the same side with the aneurism, the surgeon seeks the anterior edge of the sterno-mastoid muscle, which is indicated by a slight depression. He then, in order to discover the artery in the omo-tracheal triangle, makes an incision in the direction of this edge of about three inches in length, commencing at the level of the cricoid cartilage, and terminating near the sternum; but he makes the incision higher up, though in the same direction and with the same guide, whenever the malady permits the ligature of the artery in the omo-hyoid triangle. A second stroke of the bistoury divides the platysma and the cervical aponeurosis, and exposes the fibres of the sterno-mastoid muscle. The assistant draws the internal lip of the wound towards the median line. The operator holds the external and muscular lip outwards by means of the index and middle finger of the left hand, restores the head to its natural position, and afterwards incises the fibro-cellular stratum, which extends from the sterno-hyoid and sterno-thyroid muscles to the posterior face of the sterno-mastoid, and passes over the front of the vessels. The omo-hyoid muscle then presents itself in the shape of a narrow reddish band; if it be much in the way it is divided upon the director, but it is generally easy to preserve it by drawing it to either side with the finger, a blunt hook, or with the extremity of the probe. Above and below are seen the vein and artery enveloped in their common sheath, the anterior wall of which incloses the descending branch of the ninth pair. This sheath should be at first perforated opposite to the artery, and not the vein, with the beak of the director; it should then be divided upon the same instrument with the bistoury, to the extent of an inch or two. When the jugular

becomes so much distended, during inspiration, as to conceal a part of the carotid and embarrass the operator, compression applied at the superior angle of the wound will immediately remove this difficulty. The probe, held like a pen, is then directed between the two vessels; one or two fingers of the opposite hand fix the artery and prevent it from slipping towards the trachea, whilst by gentle movements to and fro and pressure upon the point of the instrument, the operator passes it along the posterior surface so as to raise the artery without violence, and without touching the pneumo-gastric or sympathetic nerves or any of their branches.

Remarks.—In falling at first to the inside of the sterno-mastoid muscle, the operator incurs the risk of mistaking its fibres for those of the sterno-hyoid and thus deceiving himself; it is better, therefore, to commence the incision upon its external surface, some lines to the outside of its edge: it may afterwards be easily brought back to the edge of the wound in the integuments. As the coats of the vein are extremely thin and easily torn or divided, and as the wound of such a vessel is extremely dangerous, it is of the highest importance that it should not be approached by the bistoury. For the rest it is easily distinguished by its black or bluish color, since that of the artery is grey or yellow. In isolating the latter there are two dangers to be avoided, viz.: by not isolating it sufficiently from its sheath, the operator incurs the risk of comprising in the same thread either the cardiac nerves or the branch of the hypoglossal; by isolating it too carefully, on the other hand, it is possible to destroy its *vasa vasorum*, to denude it of its cellular tissue, and to render it liable to be easily cut by the ligature. It is scarcely necessary to observe, that the *vagus* nerve is between the posterior laminæ of this sheath in the fossa between the artery and the vein. To recapitulate all the dangers which may result from its being injured, suffice it to say, that the parts should be sparingly separated, that the artery should be tied alone but without being too much denuded, and above all, that one of the conditions of success in this operation is the being able to obtain an immediate reunion.

Should the jugular vein unfortunately be opened, I do not know that it would be better to tie it than to stop the hemorrhage by thrusting pieces of lint into the wound. Mr. Simmons, of Manchester, applied the ligature without inconvenience it is true, and stoppage of the hemorrhage as above mentioned, would produce irritation and render it necessary to have the wound open; yet to say nothing of *phlebitis*, which is there the most to be apprehended, what consequences might not result from the obliteration of so voluminous a vein at the same time with the principal artery of the head? If the lesion were trifling it would be better to pinch together the lips, and encircle them with a thread in such a way as not to close the calibre of the vessel. The patient thus treated by Mr. Guthrie did not die until after another operation, which was practised some time after the first.

2. *Process of M. Sedillot.*—In order to fall perpendicularly upon the artery, to have a neater incision of less depth, and which would allow an easier issue to the fluids, M. Sedillot has recently invented a new mode of tying the carotid at the inferior part of the neck. His incision, directed much more outwards than in the ordinary process, falls upon the external surface of the sterno-mastoid muscle, of which he passes through the whole thickness between the two points of origin. The lips of this wound being separated by an intelligent assistant by means of the fingers or of hooks, the operator will find himself immediately above the vein and the artery, and has nothing to do but to separate them. This method is feasible and ingenious; but upon a living subject, on account of the jugular vein, and the contractions of the

divided muscle, it would be, I apprehend, less easy and less sure than the method before described. Consequently I am of opinion that it ought not to be adopted, particularly as the inconvenience which M. Sedillot desires to evade, is scarcely to be apprehended if the operation be well performed.

Results of the Operation.—When the carotid is obliterated, the circulation soon completely re-establishes itself in the corresponding side of the neck and head; the voluminous and almost innumerable anastomoses which it forms in the brain with the vertebral and internal carotid of the opposite side; those which are formed by the temporal, the occipitals, the supra-orbitals, the facials, the linguals, the thyroids both superior and inferior, and in short all the branches of the external carotid, form so large a net-work that the operator need not entertain the least inquietude on this point; it is rather to be feared, in fact, that these resources, so precious and so long neglected, may compromise success, by conveying too great a quantity of blood into the tumors after the operation. This is an inconvenience which actually occurs; the pulsations of the aneurism have been remarked to diminish at first, but have afterwards returned, and continued for several weeks. In the case of the patient operated upon by Mr. Walther, for an aneurism of the external carotid, they continued two months. It would be difficult to comprehend, if observation had not demonstrated that the ligature of the primitive carotid should be able to effect the cure of aneurismal affections of arteries so remote as those for example, of the orbit, or of the face, or of the outside of the cranium; but it has been proved in our day that this reflux does not always prevent the resolution of the morbid tumor, and that topical refrigerants and compression suffice to determine that resolution, or at least to hasten it. The success obtained by Mr. Mayo by the aid of this operation, in a case of hemorrhage by an ulcer of the pharynx, another mentioned by Mr. Lucke, occasioned by a pharyngeal or *laryngeal* hemorrhage, the source of which could not be precisely ascertained, offer still further proofs of the correctness of this doctrine.

B. Internal and External Carotids.

Neither the internal nor the external carotid is ever tied, nor the occipital, below the head, unless they present themselves in a wound; not that such an operation is impracticable, or even difficult, but because it is seldom possible to decide whether the aneurism belongs to this or to that branch, and because the same result may be obtained, with greater certainty and less danger, by applying the thread upon the primitive trunk itself. Still the neck presents some other branches which it may become necessary to tie; the external *maxillary* and the lingual for example, in operations upon the *maxilla* or the tongue; the superior and inferior thyroids in various maladies of the gland from which they take their name; and even the vertebral, when it does not enter its canal until it arrives at the fifth, fourth, or third vertebra.

C. Facial or External Maxillary.

To expose the facial artery an incision should be made of two inches in length, parallel to the inner edge of the sterno-mastoid muscle, its middle point corresponding with the greater horn of the thyroid cartilage. After having divided the skin, the platysma myoides and the cervical aponeurosis, removed the muscle, and exposed the carotid itself, the sheath of that vessel should be divided with the channeled probe on its anterior side, ascend-

ing towards the os-hyoides. The operator will there find the origin of the external artery of the face, which passes obliquely inwards and upwards, so as to gain the submaxillary gland and the inferior border of the jaw. The same process is applicable to the lingual artery, which is a little more deeply situated, and which begins by running horizontally before it takes a vertical direction between the hyoid bone and the muscles of the tongue.

D. Thyroids.

The thyroid arteries have been tied by several practitioners, particularly Messrs. Walther, Heden, Coates, and Langenbeck, in order to permit the extirpation of the thyroid, or to produce atrophy of that body, in cases of scirrhus or of goitre.

Operation.—Superior Thyroid.—An incision is made as above; and as soon as the sterno-mastoid muscle is withdrawn from the larynx, the operator will see, in the *omo-hyoid* space, the jugular vein and the primitive carotid; after having divided the fibro-cellular lamellæ which cover and connect these vessels, the thyroid artery, although deeply situated, is seen exposed between them and the corresponding lobe of the thyroid gland. It is occasionally hidden by some small veins, from which, however, it may be always isolated with the channeled sound, and the more easily as the operator approaches more nearly the trunk where it originates.

Inferior Thyroid.—The incision ought here to be made in the same way as for ligature of the carotid at the bottom of the neck. The thyroid artery, coming from the *subclavian*, passes behind the internal jugular vein, the pneumo-gastric nerve, and the carotid artery, ascending afterwards obliquely to the posterior face of the corresponding lobe of the thyroid gland. It is commonly concealed by the superior portion of the omo-hyoid muscle. It is necessary then to divide or depress that muscle, in order to reach the artery which is behind it, between the trachea or the œsophagus and the trunk of the carotid, taking good care to avoid the recurrent nerve and the descending branch of the great *hypoglossal.* As to the vertebral, that is found between the longus colli and the anterior scalenus, outside of the jugular vein, and accompanied by the phrenic nerve; it may consequently be discovered by the process recommended by M. Sedillot for the ligature of the carotid.

Ligature of the carotid is practised, not only when it is possible to apply it below the malady, but sometimes also according to the method of Brasdor. It is in the latter case in fact that its advantages are more peculiarly manifest, as will be explained in treating of the arteria innominata.

E. Innominata.

Art. 1.—*Anatomical Remarks.*

The brachio-cephalic trunk is about two inches in length, extending from the anterior superior part of the aortic *arch* near its right extremity to the level of the sterno-clavicular articulation, where it divides into the *subclavian* and the right carotid. It affects a slightly oblique direction upwards, and outwards and backwards. The pleura lines its external face; behind, it rests upon the front and right side of the trachea; and its anterior surface is crossed at its upper part by the left subclavian vein, and lower down by the descending cava which runs in a plane parallel to it, and which removes from it by

degrees as it approaches the right auricle of the heart. It is covered, besides, only by the cellular tissue, the root of the sterno-hyoid, and sterno-thyroid muscles, the superior and right portion of the sternum, and slightly by the sterno-clavicular articulation of the same side.

Anomaly.—This remarkable artery presents numerous varieties; it may be wanting, or it may be found on the left side; it may be longer or shorter, and may furnish at the same time the right and the left carotid, of which Walther, Malacarne, Scarpa, and others, cite examples. It may proceed from the left side of the *aorta*—cross the whole extent of the trachea, and yet be eventually found at the right. In one instance I saw it (and my attention has been since called to two similar cases at the practical school), passed to the left, cover the trachea, make the circuit of that canal from front to rear, and return, crossing between the posterior face of the œsophagus and the vertebral column, to the level of the first rib, there to be distributed as usual.

Art. 2.—Surgical and Historical Remarks.

Aneurisms of the brachio-cephalic trunk have been very frequently observed. Sharp, A. Burns, Messrs. Mott, Græfe, Wardrop, Devergie, Vosseur, &c. have made known several examples. But spontaneous aneurism, either by dilatation or by rupture of the internal or middle coat, is nevertheless almost the only kind to which it is subject.

A case which came under the observation of Pelletan, in which the subclavian, the right carotid, and the extremity of the innominata, were obliterated during life without producing any serious inconveniences, and another of the same kind related by Mr. W. Darrah, in which the brachio-cephalic trunk and the left carotid were completely closed, prove that the circulation may be maintained in the superior extremity, although the arteria innominata may have ceased to give passage to the blood. Some surgeons therefore have had the boldness to apply the ligature upon it for aneurisms of the neck, which were situated too low to permit the tying of the carotid itself. Dr. Mott practised it for the first time on the 11th May, 1818, upon a young man twenty-seven years of age, and had at one time every reason to believe that the operation would prove successful. The death of the patient did not take place until the twenty-sixth day; the circulation had been re-established in the member, and on the twentieth day the patient was so far recovered as to be able to walk about in the court of the hospital; but at the commencement of the twenty-third day several hemorrhages occurred, and the patient expired in a state of extreme exhaustion. There was no inflammation either of the aorta, the lungs, or the pleura; a firm and adhesive clot filled a part of the innominata below the ligature, but an ulceration occupying the other side of the artery had given rise to the hemorrhages. In 1822, M. Græfe repeated the operation of the professor of New York; his patient lived fifty-eight days, and expired in consequence of having made some violent movements which occasioned profuse hemorrhage, and perhaps, as M. Græfe himself observes, because it had been thought best to leave a *presse-artere* in the wound until that time. These two cases demonstrate that ligature of this trunk presents some chances of success, and that it ought to be practised when the art offers no other resources, and when the death of the patient appears otherwise inevitable. We are now happily permitted to hope, that in future the operator will not be reduced to this painful alternative. Ligature between the tumor and the branches of this artery will probably henceforth be practised, although, out of four examples which we possess of this mode of procedure, only one

can be said to have been decidedly successful in aneurism of the trachio-cephalic trunk itself. In following this mode it is necessary to tie at the same time both the carotid and the *subclavian*; this, however, has never yet been done. Mr. Wardrop upon one occasion, when unable to discover any pulsation in the carotid, tied the *subclavian*; the tumor became much diminished in size, but after death it was discovered that the carotid trunk was not affected. Taken together, the cases of aneurism, whether of the innominal trunk or of the cephalic artery, which have been subjected to the method of Brasdor, are nine in number: three out of these were successfully treated. Two other subjects who were believed to have been cured, eventually died. The patient under the care of Mr. Evans ran the greatest risk. The female operated upon by Mr. Key died the same day. It is doubtful, therefore, whether this method will actually afford, even upon the carotids, the success which it at first sight seems to promise. However, as it is possible that an aneurismal tumor of the neck may be so placed as to prevent the operator from acting upon the carotid low down, and there may be reason to believe that the arteria innominata preserves its attributes of the normal state, I proceed to explain the method of subjecting it to the ligature.

Art. 8.—Modes of Operation.

1st. *Method of Dr. Mott.*—Dr. Mott made an incision of about three inches in length above the clavicle, extending from the outer part of the sterno-mastoid to the front of the trachea; he then made another incision of the same length along the internal edge of the sterno-mastoid muscle, causing it to fall upon the internal extremity of the first. He afterwards divided the whole sternal portion and a great part of the clavicular origin of the same muscle, so as to turn it outwards and upwards. After having pushed aside the jugular vein, the *subclavian*, and some little veins and the surrounding nerves with the handle of the scalpel, he discovered the carotid. Seeing that it appeared diseased, he proceeded to the brachio-cephalic trunk, around which he passed and tied a simple ligature of silk.

2d. M. Græfe performed the operation in a similar manner, leaving, however, an instrument in the wound, by which pressure might be suddenly applied to the artery in case of hemorrhage. Mr. Porter, also, in 1829, tied the carotid in the same way, very low down; his patient perfectly recovered.

3d. Others have been of opinion, I know not from what cause, that it would be better to *trepan the sternum;* but the best operation, that which is executed with the greatest facility upon a dead subject, is the following, which differs very little from that which was devised by Mr. O'Connell, of Liverpool, and which Mr. King has described in his thesis:—

4th. The operator, placed on the left side, makes an incision in the supra-sternal hollow of the neck, of about two inches in length, upon the internal edge of the *left* sterno-mastoid muscle, obliquely, from the outside to the inside, or from left to right; divides successively the skin and the subcutaneous stratum, the superficial layer of the *fascia cervicalis*, the adipose cellular tissue (more abundant below than above), and a second fibrous lamina; afterwards encounters, behind the sterno-thyroid muscle, the thyroideal plexus, and, when it exists, the thyroid artery of Neubauer; removes, or causes to be removed by an assistant, the last mentioned vessels, or ties them when it is not possible to avoid them, and then arrives at the trachea. Here the left *subclavian* vein and the internal jugular of the opposite side present themselves; these it is necessary to detach and push with caution to the right and upwards,

by means of the probe. The operator then slightly flexes the head of the patient, and endeavors, by directing the fore-finger between the trachea and the right sterno-hyoid muscle, to feel the artery; having discovered it, he first isolates its concavity, by passing from front to rear, between it and the superior *cava* vein, with all possible care, the extremity of a probe very slightly curved. He then passes this instrument in the same manner on the side towards the trachea, in order to denude its posterior surface, and to raise it; slightly augments the curvature of the probe, which serves to direct the eyed stylet, whether directed from front to rear and from right to left, or from rear to front and from left to right, taking care also during the whole of this procedure, to avoid tearing the pleura, touching the *vagus* nerve which is left on the right, and using too roughly the subclavian vein: it would perhaps be better, in fact, upon a living subject, to raise or depress this vein so as to pass the sound between it and the trachea, than to withdraw it as I have above directed. This process, undeniably more simple, more rational, and less dangerous than any other, has also this advantage, that the same incision would serve equally well for the ligature of either of the subclavian arteries within the scalenus, and of either of the carotids at their origin.

Results of the Operation.—After the obliteration of the brachio-cephalic trunk, the blood is brought back by the branches of the carotids and the left subclavian, which convey it into the analogous canals of the right side; afterwards these latter, that is to say, the thyroids, the cervicals, &c., transmit it to the supra-scapulars, the external thoracics, the acromial, the common scapular, the circumflexes, and so on to the whole of the superior member, which is also additionally supplied through the medium of the intercostals and of the internal mammary. It is not, therefore, any deficiency in the circulation that is to be apprehended after an operation of this kind, but rather the division or ulceration of the artery, rendered almost inevitable by the proximity of the heart and the volume of the vessel, together with effusion into the pleura, and inflammation of the aorta, of the pericardium, and even of the cavities of the heart.

Method of Brasdor.—The application of the method of Brasdor in the neck, offers nothing peculiar. If the aneurism be of the cephalic artery, that trunk is tied in the omo-hyoid triangle. If it occupy the root of the *subclavian* it is equally requisite to tie this trunk, and necessarily on the outside of the scalenic. Supposing the brachio-cephalic itself to be affected, the operation beyond the tumor is the only resource; and when the malady limits itself to the carotid, however low it may be, this operation ought to suffice. Consequently, I see only two circumstances capable of rendering the ligature of the brachio-cephalic trunk necessary. 1st. When an aneurismal tumor, sufficiently developed to reach to the origin of the secondary carotids, yet leaves sufficient space above the sternum to admit of an operation, but when the trunk without, being dilated, is found diseased to its origin. 2d. When, the subclavian only being affected, the alteration of its coats is prolonged too far towards its root to allow of its being tied, and when it is not certain that the method of Brasdor would be successful. It is, therefore, an operation which ought seldom to be performed, and which is rarely, if ever, indispensable.

Aneurisms have also been seen to develop themselves upon other parts of the body. Pelletan saw upon the summit of the shoulder a pulsatile tumor, which he took for an aneurism of the acromial artery. Ruysch and A. Petit, Weltin and M. Briot, saw each an example on the chest, in the passage of the intercostals. Thinking to open an abscess, Desault plunged his bistoury

into an aneurism of one of the thoracic arteries, and M. Floret, in his thesis, speaks of a case in which the first four intercostals offered, from space to space, a great number of true aneurisms. Supposing these facts not to belong to other maladies, they are involved in what has been already said of the axillary artery, and in the discussion of the ligature of the intercostal artery, which will be taken up under the article *empyema*.

CHAPTER III.

NÆVI MATERNI.

Erectile Tumors.—Left to themselves, the sanguineous tumors, which have their origin in a connatural blemish, and the nature of which modern practitioners have caused to be better understood than formerly, sometimes acquire considerable volume. Lassus met with one which was as large as the head of an adult, and M. Latta extirpated another which did not weigh less than fourteen ounces, although it occurred upon an infant of two years. As the organization is not able to effect the removal of these aneurisms, prudence dictates that they should never be neglected when they begin to increase with any degree of rapidity, or when they have already attained a considerable size. The same remarks apply to accidental erectile tumors of every species, which have their seat either in the venous or arterial system, and which may manifest themselves at any period of life.

1st. *Astringent Remedies*, styptics, or refrigerants, although frequently employed by the ancients, and recommended by Abernethy, who by these means in the course of some months caused the disappearance of an erectile tumor of the orbit, are yet seldom alone found sufficient, and ought never to be tried but in cases where the tumor is too small to excite much apprehension.

2d. *Compression.*—Although it is not a resource upon which the operator can place much reliance, compression has yet succeeded often enough to justify its use whenever the volume and situation of the tumor permit. Batteman, it is true, speaks unfavorably of it, and says that it exasperates the malady; but it has been used with incontestable success by Burns, Abernethy, and Mr. Randolph. M. Roux cured one of his children by these means, and M. Boyer, who hardly dared to recommend it, cites a case of nævus of the lip cured by the tenderness of the mother, who had the constancy to press her finger seven or eight hours a day for several months below the nose and across the lip of her child. In the case of a child a few months old, troubled with a small erectile tumor in front of the breast, M. Roux, after having renounced compression, saw the swelling decrease and eventually disappear. Styptics and astringents may be also very advantageously associated with compression.

3d. *Caustics.*—Caustic plasters, or simple escharotics, vaunted by Callisen, Wardrop, &c.; nitric acid, still used in England; nitrate of silver, recommended by Mr. Guthrie when the nævus is small or not very thick; and the multiplied vaccine punctures praised by M. Cumin, are evidently insufficient,

except in a very limited number of cases. The hot iron which was successfully used by M. Maunoir, and all active caustics, when they do not completely extirpate the evil, are sometimes attended with the most serious consequences, such as consecutive hemorrhage, and acceleration of the progress of the tumor. The loss of substance, the suffering, and the deformed cicatrices which follow the employment of these means, are enough in fact to prevent every prudent and humane practitioner from having recourse to such means when any other afford a chance of relief.

4th. *Ligature of the Tumor.*—It is not so with the ligature, which may be employed in several different ways. In one, that of Mr. White, the operator draws the tumor towards himself with one hand in order to remove it from the subjacent tissues, while with the other, he passes a needle with a double thread through the skin behind the fungus, which latter may afterwards be easily compressed or strangled by bringing the extremities of the ligatures together, and tying them, the one above and the other below. Mr. Lawrence, who is from experience opposed to cauterization, has published three observations, sufficiently conclusive, in favor of the practice of Mr. White, which practice has also been adopted by Messrs. Lyne, Carlisle, Guthrie, and for a long time, says the latter, by the surgeons of the Westminster Hospital. By another mode of operation no tissue is pierced, but the operator contents himself with embracing circularly and with a strong ligature the base of the nævus. This method is not confined to pediculated tumors. M. Gensoul, of Lyons, according to M. Penod, still uses it with success whenever the base of the tumor is not immoderately large, and the skin which surrounds it is sufficiently flexible and movable to yield without difficulty to the action of the ligature. But there are many cases in which the ligature is totally inapplicable by either method. Finally, Mr. Keate, and after him Messrs. Lawrence and Brodie, adopted a third mode of procedure, which consists in passing a single straight needle, if the *nævus* is small, or two needles crossed under the tumor if it is large; the tissues are afterwards strangulated by means of a circular ligature, sufficiently tight, placed between the needles and the healthy skin.

6th. *Ligature of the Arteries.*—Comparing erectile tumors to aneurisms, it was natural to seek a cure by ligature of the arteries upon which they were seated. Pelletan was the first to try this method in a case of varicose tumor, which occupied the lateral and rather posterior part of the cranium; he was not able however to discover the occipital, and his operation was consequently incomplete. I have already stated that Messrs. Travers, Dalrymple, and Arendt, each cured an erectile tumor of the eye by tying the carotid of the same side, and that Dr. Pattison was equally successful in the case of a young man affected with a similar malady behind the cheek. M. Roux also derived some advantage from tying one of the facial arteries for a fungus of the lips. Other practitioners, on the contrary, have been completely unsuccessful in their operations by this method. Hodgson was unable, even by tying both arteries of the fore-arm, to arrest the progress of a tumor of this kind upon the thumb. It was in vain also that M. Dupuytren tied the carotid for an erectile mass of the concha of the right ear. For some days appearances promised success; but the tumor soon returned to its former state. It would be wrong therefore to consider this method as an unfailing resource.

6th. *Circular incision of the base of the tumor.*—Dr. Physick adopted a different process, and in some cases followed it with complete success. Instead of successively exposing all the arterial branches which supply an erectile tumor, he made an incision round the base or root, and thus in some degree

isolated it from the living tissues and the canal, which supplied it with the fluids. By imitating this method, Mr. Lawrence cured the sanguine tumor of the thumb, which has been mentioned as resisting the efforts of Mr. Hodgson. In following this mode of treatment it is necessary that the incision be made upon healthy tissues, and that it should comprehend the whole thickness of the skin, the cellular stratum, the arteries, and the veins, without being arrested by the nervous twigs, unless they have some important duty to fulfil, in the part. Each arterial branch is tied as it is divided; and to prevent immediate reunion, lint or small pieces of linen are placed between the lips of the wound.

6th. *Extirpation* is unquestionably the most efficacious resource, but it cannot be always called in. It is practised in three different ways; 1st. By conforming to the rules laid down for the extirpation of all other kinds of tumor. 2d. By removing at the same time the morbid tumor and the part which supports it. 3d. At two, three, or a greater number of operations.

The first method, which is most generally adopted, which is so strenuously insisted upon by J. L. Petit, and which Messrs. J. Bell, Wardrop, Boyer, Roux, Dupuytren, Maunoir, and Dorsey, follow from preference, requires that the operator should encroach a little upon the healthy parts, if he would prevent the reproduction of the malady. In order as much as possible to avoid hemorrhage, the arteries should be carefully tied as they are opened during the operation; by neglecting this precaution, or availing himself of it too tardily, Mr. Wardrop had the misfortune to see an infant expire under his hands. A little girl also, operated upon by M. Roux, fell immediately afterwards into a syncope which lasted four hours. The second mode of extirpation never is and never ought to be employed, excepting when it is impossible to make use of the others, or when the tumor is seated upon a small and unimportant part of the body, a finger or toe for example. The merit of the third, described in the work of Dr. Dorsey, is due to Professor Gibson, of Philadelphia. Fearing the loss of too much blood in the case of a woman aged twenty-five, and in whose person almost the whole of the right side of the head was involved in the disease, this gentleman resolved upon performing the operation at three several times. On the first occasion he incised exactly a third of the tumor, promptly secured the vessels, and kept the wound open. At the expiration of a few days, a second incision, made with the same precautions as the first, circumscribed another third of the fungous mass, and a week afterwards the extirpation of the whole was effected. The patient found herself completely recovered at the end of thirteen or fourteen days.

CHAPTER IV.

OF VARIX.

Historical.—Although varices do not constitute a malady essentially dangerous, they are yet sufficiently so to demand the aid of surgery. The pain, the deformity, and the ulcers which they cause or maintain, together with

the hemorrhages which they sometimes originate, sufficiently explain the solicitude of which they have always been the subject. The ancients, who employed against them topical remedies, astringents, desiccatives, and resolvents, used also the compressive bandage, which they applied upon the whole extent of the member, pretending also to forward its action by means of internal medications. *Then*, as *now*, those different modes of treatment were merely palliatives. To obtain a radical cure it was necessary to perform an operation. Sometimes, however, they contented themselves, like Hippocrates, and as it was recommended even by Pare and Dionis, with puncturing the varix, and incising it length-wise (more *extensively than in phlebotomy*), in order to empty it of the fluid and coagulated blood. According to Avicenna, the vein should be taken up with hooks upon two points distant, three fingers' breadth from each other, then tied with a good silk thread, and cut across in the interval; after which the ligature should be removed from the inferior end, and the blood forced out as much as possible with the hand: the superior extremity of the vessel, and the whole extent of the wound is then cauterized with arsenics or a red hot iron.

Albucasis recommends that a bandage should be placed upon the thigh as far as the knee, and that the vein should be opened and cut in two or three places, in order that as much blood may be forced out as possible.

Others extirpated the varices after having incised them; this mode of procedure, at least, seems to have been counselled by Ali Abbas. Celsus speaks of cauterization and extirpation; and every one who has read Plutarch, knows that the stoic Marius, who had been treated in this way, after having been relieved of varices which had covered the whole of one leg, refused to present the other to the surgeon, which was in the same condition, saying that the remedy was worse than the disease. Dionis is astonished that the ancients did not make use of the heated iron to extirpate varicose veins, as upon horses, and that they should have contented themselves with the potential cautery. According to this author, the rolled bandage applied in the form of buskins is preferable to all other means. It was also the advice of a great many surgeons of our own day, when an attempt was made some years ago to simplify the operations of the Greeks and Arabs.

1st. *Excision* is rarely necessary, and ought never to be practised, as has been justly remarked by Boyer, excepting in cases of those large tumors or varicose lumps which are sometimes seen on the leg, and even then it is not certain that it might not be beneficially replaced by other and simpler means.

2d. *Ligature*, so clearly and carefully described by Dionis, has been frequently practised by Sir Ev. Home, in England, and by Beclard, in France. A longitudinal fold, says M. Briquet, who reports the results obtained by Beclard, is made in the skin, and divided to its base upon a point of the member where the vein is single and most superficial. The operator then passes beneath the vein a needle stylet carrying a thread, and after having tied the ligature divides the vessel immediately above. He may also divide the skin and the vein at a single stroke, and afterwards tie the inferior extremity of the venous canal, by seizing it with pincers. The lips of the wound are closed by means of bands or fillets, and the patient should be kept in a state of perfect rest. Messrs. Smith, Travers, and Oulknow, have imitated the treatment of Mr. Home, but not with such constant success. Dr. Physick is said to have had reason to praise it, and Dr. Dorsey, by whom it was frequently tried, affirms that he never saw it produce any serious or dangerous results. Out of sixty operations performed by Beclard, at La Pitie, only two, says M. Briquet, were attended with a single unfavorable symptom. It is difficult, in fact, to

comprehend how this ligature, properly applied, can be attended with great pain, and followed, as has been pretended, by *tetanus;* or why inflammation of the vein towards the heart should be produced by this any more than by any other method which requires the obliteration of the vessel. The process of M. Gagneles, cited by M. Marchal, and which consists in passing a ligature round the vein by a simple puncture of the skin, would only render the operation more difficult without avoiding any thing that could be apprehended.

3d. *Incision.*—Not wishing to confine himself to simple incision, M. Richerand thought that by incising parallel with the member, and to a great extent the tortuosities or varicose knots, he should more certainly succeed. I have seen this method followed several times at St. Louis's hospital with perfect success, and I have myself applied it with advantage on different occasions; but the only patient upon whom I practised it at La Pitie, died on the ninth day. The operator should choose that part of the member where the varices are most numerous, and should incise them deeply, and to the extent of four, five, six, and even eight inches. After having forced out the clotted blood by pressure, he should fill the wound with lint smeared with cerate. The first dressing takes place at the expiration of three or four days. After that time the venous orifices are closed, and the wound may be smoothly dressed, like all other simple solutions of continuity. Beclard practised this method upon some occasions, and as successfully as M. Richerand. These long incisions, however, create great alarm in the mind of the patient, and upon mature reflection there appears to be little necessity for them.

4th. Would not the division of a single and selected point, or of different branches, when it is not desirable to act upon the principal trunk of the vein, be evidently preferable. I have practised it thirty-seven times at the hospital St. Antoine, and at La Pitie. One of the patients it is true died on the twelfth day, but he evinced the most extraordinary ataxic symptoms, which could only be attributed to the state of fear and inconceivable moral constraint to which he had brought himself before the operation. We did not meet with any traces of *phlebitis* above the wound, and that which existed below bore no proportion to the progress of the fatal symptoms. Nothing can be more simple than such an operation. The vein is at first taken up in a fold of the skin, and a straight bistoury, very sharp, passed across the base of this fold then divides it at a single stroke. The operator thus successively incises (when it is not thought necessary to divide the trunk of the *saphena* itself near the knee) all those veins which are at all voluminous, and which seem to take their root in the middle of every knot of varices. The blood immediately issues in abundance, and is suffered to flow for a longer or shorter time, according to the strength of the patient, after which the wound is filled with balls of lint, and covered with a cerated pledget, and with soft and flexible compresses. The whole ought afterwards to be kept in place by a rolled bandage moderately tight. If immediate union should take place, the continuity of the vein might re-establish itself, and thus cause the failure of the operation.

Hoping to avoid *phlebitis* with greater certainty, Mr. Brodie contented himself with dividing the veins transversely, making only a simple puncture through the skin. He used a bistoury with a narrow blade, and a little concave on its edge. The point of the instrument is at first passed through the integuments on one side of the vein; it is then directed flatly between that vessel and the skin; and when it reaches the opposite side the edge is turned backward and the wrist of the operator is raised in such a way as in drawing back the bistoury completely to divide the vein. Mr. Carmichael and other

practitioners, have highly praised this process; a patient, also treated in this way in my presence by M. Bougon, found himself perfectly relieved; but Beclard, who practised it at La Pitie, says that it does not offer any greater security against phlebitis or phlegmonous erysipelas than the ordinary incision, and besides, that it sometimes fails to obliterate the vein.

5th. *Resection*, which was practised so early as the times of Ali Abbas, Avicenna, Albu-Kasem, &c. have given to M. Lisfranc more satisfactory results than the simple incision. By retracting under the lips of the wound, the two extremities of the vein immediately cease to be subject to the influence of the external air, the action of which, according to Mr. Brodie and Lisfranc, is a powerful cause of *phlebitis*.

Comparison.—To obliterate veins which have become varicose, is the avowed and incontestable aim of the operator; yet it cannot be denied that the ligature, with or without division, the section transverse or longitudinal, exposed or under the skin, that even extirpation itself, as well as cauterization with potash or the red hot iron, are insufficient to effect this result.

It only remains, therefore, to decide which of these means may be most easily executed, involves the least danger, and causes the least pain. In my opinion the transverse incision of the vein comprehending the skin, promises all the advantages of the other modes, together with all desirable simplicity. It is performed in the twinkling of an eye; the youngest student may perform it with ease; the pain is trifling, and the whole operation differs very little from an ordinary bleeding. The ligature, so much vaunted by Hone and Beclard, is only calculated to render the operation more difficult and dangerous. And why should the practitioner expose himself, by imitating Mr. Brodie, to the probability of leaving the vein partially divided, and seeing the blood effused into the subcutaneous stratum, forming the point of departure, the *nucleus* of a phlegmon or an abscess? Ought the division of the skin ever to cause uneasiness after such an operation? And who does not now know, that the action of the air upon the veins is incapable of producing any of those terrible effects which have been so gratuitously ascribed to it? As to the long and deep incisions recommended by M. Richerand and formerly by J. L. Petit, and the excision of Celsus as practised by M. Boyer, they ought not to be thought of, excepting in cases where varices form painful masses, and have degenerated into tumors which will yield to nothing but extirpation.

But after all, is it right to resort to the most easy and least painful of these operations? Does not humanity revolt at the idea of *phlegmons*, erysipelas, purulent collections, *phlebitis*, and all the other accidents which have more than once resulted from them, in cases where the varices did not at all endanger the lives of the patient? Why should not the operator content himself with a laced stocking or rolled bandage, which would maintain the parts in a proper position without any risk to the patient? These objections appear to me more specious than solid. It is not perfectly correct to say that varices are unattended with danger. Chaussier cites an example of a ruptured varicose vein in the case of a pregnant female, which quickly produced death. Similar instances have been mentioned by Murat, Grimaud, Amussat, Rees, La Croix and Lebrun; and one case fell under my own observation. The death of Copernicus is attributed to such an accident. The bandages or gaiters which are so earnestly recommended, require care and precaution in their use, and often cause excoriations upon different points of the member, so that they are not entirely without their inconveniences. Finally, those ulcers which it is so difficult to cure, and which almost always

return when the patients make the least exertion—which are the despair of the surgeon and the misery of those who are so unfortunate as to be afflicted with them—will any one say that they never produce death, that they are never the cause of any serious maladies, and that they never make it necessary to amputate the limb?

On the other side, if it be true that after the incision of the veins phlegmonous inflammations and engorgements of various kinds sometimes take place, that even *phlebitis* may manifest itself, it is not less true that all these accidents are very rare, that they are generally easily remedied, and that above all, they may be almost always prevented, if, after a simple incision such as I have described, the operator takes the precaution, when there is reason to fear inflammation, to envelop the member from its extremity to its root with a compressive bandage. It should always be remembered, however, that these operations cannot be counted upon as infallible, and that they ought not to be practised excepting in cases where the deep-seated veins are in their natural state, at the demand of the patient, and when the varices have proved capable of impeding the functions of the injured part, or of compromising the general health.

TITLE II.—OF AMPUTATIONS.

CHAPTER I.

AMPUTATIONS IN GENERAL.

Amputation, the last resource and extreme effort of surgery, ought never to be practised but in despair of other remedies. It is of a doubly serious nature, inasmuch as it endangers life and mutilates the body. Even when amputation seems necessary, the skillful practitioner will never forget that the end of surgery is to preserve, not to destroy; and that he will be entitled to greater credit for preserving one limb, than he would for making with all imaginable address a great number of amputations: on the other hand, it is better to sacrifice one part than to lose the whole—to live with three members, than to die with four.

The painful necessity of cutting away the whole or a portion of one of the appendages of the trunk, has been felt and acknowledged from the earliest years of surgical experience. The mortification and natural and accidental dropping off of the members, which must have been observed among the ancients, as well as among ourselves, doubtless suggested the first idea of amputation. It was rarely, however, that they decided upon its execution. The Hippocratists give very few details upon this subject. Galen himself, elsewhere so prolix, scarcely mentions it, and it is not until we come to Celsus that we find a description of the operation somewhat more at length. This negligence on the part of the ancient authors, is, however, easy to be understood. Knowing little of the circulation of the blood, they were unable to guard against he-

morrhages, and were constantly impeded by their fear that death would result from the cutting away of a living portion of the body. Again, before the discovery of gunpowder, wars were less murderous in their nature, and rendered amputation also less frequently indispensable.

In the beginning they were obliged to content themselves, as is recommended by Paulus Ægineta, with cutting off the dead parts without touching the living tissues, and this practice, which was continued by the surgeons of the middle age, is still recommended by Fabricius de Aquapendente. Although the old surgeons scarcely speak of amputation excepting in cases of gangrene or erosive ulcers, it is nevertheless certain that they early admitted the necessity of dividing the tissues above the mortified parts. Celsus formally prescribes it, and Achigenes, of Apamea, appears frequently to have executed it. Always terrified at the hemorrhages which ensued, they imagined a thousand means (now forgotten) of preventing it, and the operation became eventually so terrible to them, that many, rather than practise it, preferred leaving the patient to certain death. In performing amputation, some commenced by tying the vessels by means of a ligature passed through the whole thickness of the limb, or by compressing the limb itself, and afterwards sprinkling it with cold water. The operation being terminated, the surface of the stump was burnt with a red-hot iron. Others, after the manner of Albucasis, incised the soft part with a knife heated to whiteness, and afterwards cauterized with boiling oil. This latter author, less timid than is generally believed, says: "When it is not possible to preserve the limb, it should be cut away up to the healthy part, since the loss of one member is better than the death of the whole body." Avicenna, according to the celebrated Guy, recommends that amputation should be performed a little above the diseased tissues, "at the place to which hardness and pain are discovered on the introduction of the tent." In practising this operation, the member is at first firmly held by the assistants; the soft parts are then divided to the bone with a razor, and the surface of the wound is covered with a compress in order that it may not be lacerated by the saw; the surface of the stump is afterwards cauterized with a hot iron or boiling oil. "As to myself," says Guy, of Chauliac, "I envelope the whole of the mortified member in a plaster, and suffer it to remain in this state until it falls of itself. This is more honorable to the surgeon than amputation; for if the limb be taken off, there always rankles in the heart of the patient a belief that it might perhaps, have been preserved." In despite the efforts of Pare to introduce the practice of tying the vessels after amputation, Pisray, Dionis, and Rossi, still preferred the actual cautery. But surgery has long since done justice to this barbarous practice. It appears that from the time of Hippocrates and Galen amputation was admitted as a surgical resource, although Heliodorus, who lived between those two authors, endeavored to proscribe it.

Amputation was also practised by the Arabs; for it is said in their books, that if the corruption extends to the joint, it will be necessary to cut into the articulation itself with the razor or other instruments, without using the saw. The method of Celsus, although defended by Gersdorf of Strasbourg, by Cervia a long time before, by Maggi and some others afterwards, was, notwithstanding, abandoned by the greater part of practitioners; so that in the seventeenth century Botal was not ashamed to perform amputation by means of two hatchets, one placed immediately below the member and the other, loaded with lead, let fall upon it. Finally, from the time of Ambrose Pare and Wiseman, the mode of practice became materially changed, and the operation is now performed with much less danger.

SECTION I.

INDICATIONS.

Cases which require amputation merit particular attention, and will become it is to be hoped, less and less numerous as medical knowledge advances, and as the just treatment of diseases comes to be more generally understood.

Art. 1.—*Gangrene.*

Mortification.—The only circumstance which was formerly supposed to justify the amputation of a limb, is not now the cause which most frequently renders the operation requisite, although it must be confessed that it forms one of the most positive indications. Amputation in this case is only warranted when the mortification has invaded the whole thickness of the part, or at least when it is sufficiently deep to leave no hope of preserving its principal elements. With regard to amputation, gangrene involves a question which some moderns have attempted to solve differently from the ancients. Pott, and before him, Sharp, strenuously maintained the necessity of waiting until the organization had arrested the progress of mortification and established its limits, before thinking of amputation; without attention to this particular say they (and the majority of surgeons agree with them in opinion), the mortification will affect the stump, continue to propagate itself in the direction of the trunk, and will only be arrested by the death of the patient, while the surgeon will have performed to no purpose a most painful operation. This manner of viewing the matter, founded upon an exact observation of facts, ought to be adopted as a general but not as an absolute rule. Messrs. Larrey, Yvan, Lawrence, Dupuytren, Gouraud, Guthrie, and Chaussier, who, while justifying the conduct of M. Labesse of Nancy, in a case of this kind have admirably established the distinction necessary to be made. Messrs. Macdermott and Busch, who have recently reported several observations on this point, and many other modern surgeons, have proved that it is sometimes prudent to pursue an opposite course of conduct, and to practice amputation before the gangrene has become limited. For example, when a traumatic injury is the cause of mortification; when it proceeds from the rupture of an artery or the division of the vein or principal nerves of the member, or from the mechanical compression of the part; when in fact it does not seem to result from a constitutional affection, from any external or hidden cause; it is difficult to see what real advantages can result from temporizing. Gangrene ought here to be considered as a cause of gangrene, and as soon as that is well established the patient cannot but be a gainer in being relieved as speedily as possible from the presence of the mortified parts.

If gangrene on the contrary, proceeds from the spontaneous obliteration of the artery or principal vein of the member, as is frequently the case, then, indeed, it is evident that amputation will not prevent it from spreading. The success of the operation would then still be a matter of chance. The object of the practitioner might be accomplished if the knife fell above the obliterated part, but the reverse would be the case if it did not. In such a conjuncture, prudence requires one to pause. So that senile gangrene, which comes under this head, will not, even if the general state of the patient do not exclude the idea of amputation, permit us to resort to it until the disease have

paused in its ravages, and its limits have been marked by an inflammatory line. The point, then, is to distinguish these two cases from each other.

Art. 2.—Fractures.

Complicated fracture is one of the causes which most frequently render amputation necessary. But to do this it is necessary that the fracture have been attended with serious injury of the soft parts. When the artery, the vein, or the principal nerves remain unbroken; when the muscles preserve a partial continuity; when, in short, gangrene does not appear inevitable, it is always prudent to wait a little and to try in every way to obtain a cure without mutilating the patient. If fragments of bone or splinters, are free or buried in the flesh, they are to be extracted; but if the extremities of either portion of the fractured bone appear without and cannot be reduced by deep incisions or other justifiable means, it is thought good to remove them with the saw. Even when the muscles are so bruised as to be reduced to a sort of jelly, it does not follow (if any of them remain entire, and there is a possibility of the circulation of the fluids below the fracture), particularly if the thoracic limb is concerned, that the member should of course be sacrificed. Three male adults who had experienced fractures of this nature in the leg, were cured without amputation at the hospital of St. Anthony, in 1829 and 1830, although two of them, becoming suddenly delirious on the sixteenth or eighteenth day, got up with their dressings on, and walked about the hall of the hospital. I saw at *L'Hopital de Perfectionnement*, a case in which all the muscles of the internal and anterior region of the fore-arm had been lacerated and beaten almost to a jelly by a spinning machine. The skin was also injured, and the radius and ulna fractured in two or three places. The patient, a young man, having several times refused amputation, eventually recovered without an operation and preserved the limb. In civil practice the surgeon should never lose sight of the following remark, viz: that with care, proper regimen, and all the resources of a scientific treatment, it should be rare to find complicated fractures immediately demand amputation. It is, however, sometimes indispensable, particularly when the fracture reaches so far as the next articulation. Out of three subjects who presented themselves in this state, at St. Anthony's hospital, and whose legs I tried to preserve, two died in a few days, and the life of the third was only preserved by amputation, which was practised on the fourteenth day in consequence of gangrene. It is true that a fourth upon whom the operation had been performed immediately, died, notwithstanding, on the seventh day; but in that case the sources of vitality were so nearly dried up at the time of the operation that the patient scarcely knew what was done to him. To the numerous facts brought forward by M. Bardy in 1803, for the purpose of demonstrating that in these cases removal of the limb is scarcely ever necessary, M. Bintot has opposed others not less conclusive, in support of the contrary opinion.

Art. 3.—Luxations.

Luxations with laceration of the soft parts are sometimes followed by symptoms so formidable, so terrifying, that they were at an early period classed with those cases which most imperiously call for amputation. The opinion expressed by a military surgeon, and which made so lively an impression upon the mind of J. L. Petit, viz. that all luxations of the foot, with laceration of the integuments and cutting out of the bone, would prove mortal, unless

amputation were immediately practised, has been but too often verified. The dreadful pain which follows their inflammation; the gangrene which frequently results from them, and which nothing can arrest; and death, preceded by the most lively agonies, which alone seems capable of terminating so many evils, appear sufficient to justify the surgical rule established upon this subject.

Yet experience has proved that there may be many exceptions to this rule; J. L. Petit himself has been very careful to remark this, and M. Laugier, M. Arnel, &c., have very recently given new proofs of the fact. If the laceration is not very extensive, if the bones are simply luxed without being broken, if the nerves and principal vessels are not divided, and if gangrene does not appear inevitable, the surgeon should replace the parts, have recourse immediately to scarifications, antiphlogistics, and anodynes of every kind; should combat with energy any unexpected or unpleasant symptoms which may make their appearance, and should never resort immediately to amputation, unless the integuments, tendons, ligaments, and articular capsules are extensively lacerated, the bones and soft parts torn and violently contused, or the joint too complicated or too unimportant to justify an attempt at its preservation. By proceeding thus, some patients whose lives might have been saved by amputation, will perhaps be lost, but a far greater number will be cured, and preserve their limbs.

Art. 4.—Caries, Necrosis.

The last remedy of caries and *necrosis*, whether of the middle part or of the articular extremities of the bones, is also amputation. To justify its use, however, the disease should be extensive; have existed for a considerable time; have caused great suffering or an exhausting suppuration; should occupy an articulation and an extended surface, or be surrounded by fistulous ulcers and deep degeneration of the soft parts; the bone should be affected throughout its whole thickness, if in the continuity of the limbs; and reproduction through the vessels of the periosteum cannot be counted on. It should also in such cases be remembered that the organization is very powerful, and that the surgical art actually possesses the means of partially removing the bone without removing the limb, when the soft parts are in a state to be preserved.

Art. 5.—Cancerous Affections.

Spina ventosa, osteosarcoma, the colloid, hydatoid, and erectile degenerations, give less latitude, and demand much more positively a resort to amputation. These affections are of so malignant a character, that the practitioner, even of the present day, may consider himself fortunate if he is able to destroy them finally by sacrificing the part upon which they are situated. Unless they occupy a very superficial, long, and slender bone, it is wrong to hesitate an instant. However little the soft parts may participate in the disease, amputation cannot be dispensed with. The same observation applies to the fungus hematodes, from the moment that it becomes impossible wholly to extirpate it without affecting the continuity of the bone or bones of some important parts of the limb. M. Hervez, of Chegoin, has perfectly established the point, that extirpation or amputation, when practicable, is the only efficacious remedy for sanguineous fungous tumors, with a mixed mass of heterogeneous tissues, brainlike matter for instance, as soon as they have invaded to

a certain extent the thickness of the organ. But we should be cautious not to confound the above with simple erectile tumors, which at the present day are often cured by gentler and less painful methods. As to cancers, properly so called, there is no necessity for waiting until they penetrate to the bone before amputating. If they are large, immovable, and extend beyond the integuments, comprising the aponeurosis, the muscles, and the vessels or the nerves, the safety of the patient would be compromised by any attempt to preserve the limb.

Art. 6.—*Aneurisms.*

For the cure of aneurisms and simple wounds of the great vessels, other and more simple means are now adopted. The ideas of Petit and Pott upon this subject are rarely applicable at the present day, and can only be adopted in cases where gangrene threatens, or already exists; when the aneurism is too voluminous, and the surrounding parts too deeply affected for the ligature to afford the least probability of success; or when, after the ligature, secondary hemorrhages, caused by the ossification of the artery or by mortification, unexpectedly ensue; when the principal nervous trunks are divided, or the vein has been enclosed in the same ligature with the artery; when the muscles have been reduced to a soft mass, or become disorganized in any way whatever; or when the neighboring bones are themselves affected, have become brittle, or are to a greater or less extent destroyed.

When a coach-wheel, a machine, or any exterior agent whatever, has effected amputation, either by tearing away the part or in any other manner, the member, being in the same state as after gangrene, requires amputation above the accidental division as much as if it had suffered nothing but attrition and contusion of the tissues.

Art. 7.—Suppurations.

Suppurations, either of recent or of long standing, superficial or profound, however large, seldom absolutely require amputation, unless they have their origin in a disease of the bones. Regimen, a skillful application of medicines, incisions, and convenient dressings, should generally suffice in the early stages of the disease. Otherwise, the cause should be sought in the general state of the patient, or may be traced to some internal affection, and then amputation would only tend to hasten the progress of the evil. It is impossible to shut the eyes against the danger to which the patient is exposed by those suppurations which sometimes invade the greater part of a limb, and which are commonly the result of an inflammation of the synovial and tendinous laminæ, of the intermuscular cellular tissue, &c. As these dangers, however, do not always exist; as death is not always the inevitable result; as it is possible to combat them advantageously, or what is better still, in a great number of cases to prevent them; the suppuration of the parts, without alteration of the bones, ought not to be classed among those cases which require amputation. The only patients (three in number) who ever suffered amputation in my presence, died as soon as if the operation had not been performed upon them. In the case of the first two a suppuration, which the most numerous incisions had not been able to arrest, occupied the whole of the forearm; in that of the other, the malady approached the wrist and extended nearly to the elbow; all three lost their arms and died before the fifteenth day, having purulent *depots* in the bowels.

These remarks apply also to exostosis, and to fibrous or other tumors; unless they are very voluminous, compromise the general health, or destroy the natural uses of the parts, and absolutely cannot be separately removed or detached from the bones, or the neighboring organs most essential to the maintenance of life in the rest of the limbs.

Art. 8.—*White Swellings.*

The numerous observations published of late years by Messrs. Larrey, Brodie, and Lisfranc, prove that white tumors will also yield more readily than is generally supposed to the rational use, therapeutic means, and that it would be unworthy an honest man to amputate the affected member, until the caries or suppuration of the articular surfaces became evident, and before having exhausted every resource that prudence permits to be employed. If the capsule on the contrary has been long filled with pus, if there be fistulous sores about the joints and rubbing over the parts, or the introduction of the probe leaves no doubt as to the extent of the caries or the *necrosis*; if the ligaments and the surrounding fibrous strata are destroyed; if an ichorous and abundant liquid escapes from them; if the fungous or fatty alteration has seized upon the synovial membrane and the soft parts generally; if the member is in a state of atrophy above and below, is luxed or has a tendency to become so; if, in a word, it is demonstrated that the bones or cartilages have been for a long time the seat of a deep morbid action, the necessity of amputation may then be said to be formally indicated.

Art. 9.—*Tetanus, Bites of Rabid Animals.*

Erosive ulcers of the legs, which formerly were considered as particularly demanding amputation, do not really require it, and can only justify its use in very few cases: when, for example, the skin is destroyed, or the muscles separated round the greater part of the limb; and even in these cases, the consent of the patient should be obtained, and he should be convinced, before submitting to the operation, that there is no possibility by any other means of effecting a cure. Did M. Larrey, M. del Signore, and some others, derive any benefit from the amputations which they had the courage to practice in certain cases of *tetanus?* were not those cases on the contrary rather aggravated than relieved by the removal of a limb? I remember, it is true, the case of a countryman whose life was thus saved some years ago by M. Dubois, and I am aware that our medical annals present here and there some instances of success obtained by the same means: but two of the patients upon whom M. Larrey operated died notwithstanding the amputation, and the case of the third was such as to leave great doubt in the mind as to the real nature of the disease with which he was affected. If the wound itself which has occasioned *tetanus* is of sufficient importance to justify an extreme resource, the appearance of such a frightful event may certainly be permitted to have some weight as a determining motive. There is less room for hesitation too when the part is of small importance; but in other cases I am so much the less disposed to follow the practice of our celebrated military surgeon, as amputation is well known to be a powerful cause of the very evil which it is here intended to cure. The bite of rabid animals is also by some practitioners considered a sufficient cause for amputation. Very recently, at a London hospital, Mr. Calloway did not hesitate to amputate the arm of an individual who had been bitten in the hand; and who (by way of parenthesis) died shortly afterwards of hydro-

phobia. What could such an operation effect against an infection already disseminated, against symptoms which evidently have their immediate source in the intestines, or some general organic system, which, in a word, are altogether independent of the primary injury? At the most, amputation can only be permitted when a part like a finger has been bitten, unless the wound is so extensive, complicated, or deep, as to forbid cauterization, or prevent a thorough removal of the sides of the wound. But even then, amputation should be immediate; for when once an absorption of the *virus* has taken place, what can we hope from amputation?

Art. 10.—*Amputations of Convenience.*

Anchylosis, complete or incomplete, deformities of different sorts, old and incurable ulcers, or those the cure of which is never durable, affections which hinder the use of some of the limbs, frequently induce patients to ask us to relieve them at any sacrifice, although neither life nor health is compromised by the existence of the malady. As a general rule, a prudent surgeon ought always to resist the solicitations of those who consult him on this point. It has been observed, in fact, that these operations which are called amputations of complaisance, usually terminate unsuccessfully. In the year 1821, a robust man in good health and in the prime of life, came to the Hospital of St. Louis with the fixed determination of having an operation performed at the thigh for an anchylosis of the knee, which obliged him to use a crutch in walking. After having remonstrated with him in every possible way, and represented to him in the most forcible manner the dangers to which he would expose himself, M. Richerand at last, although with great regret, acceded to his wishes. Amputation was practised in the most simple manner; no local accident occurred, but a low fever, which speedily developed itself, brought on death on the fifth day after the operation. A similar fact is recorded by M. Pelletan. I also myself witnessed instances equally striking, at the Hospital of Tours, in the years 1815 and 1820, and M. Gouraud, then surgeon-in-chief to that establishment, came to a resolution to refuse in every such instance. In 1825, a countryman, who had formerly been a soldier, tired of carrying a dry ulcer behind the malleolus, presented himself in the hall of the clinical department of the school of medicine, with the intention of having the limb removed. M. Roux in vain endeavored to alarm him, by representing the probable consequences of such an operation: the patient was not to be shaken. Amputation was accordingly performed; nothing particular occurred at the time of the operation, but in a few days, general symptoms appeared, and the subject expired in about a week from the time of amputation. The worst of these cases is, that amputations the least important in themselves, those of a finger or toe, for example, are often followed by equally serious results. In 1829, a shoemaker who had had the left index finger for a considerable time immovably fixed upon the palm of the hand, came to me at the hospital St. Antoine. Prevailed upon by his solicitations, I operated, and separated the finger from the corresponding metacarpal bone. The amputation was not at first attended with any disagreeable consequences, and the patient was eventually cured, but for fifteen days he was so seriously affected, that on two different occasions I thought him beyond recovery. Nothing is more frequent than cases of this description, and there is scarcely a practitioner who has not observed a certain number of them. From these circumstances has arisen the following surgical question among the moderns, and which the ancients do not seem to have thought of:—ought the skillful

practitioners to be influenced by the representations of the patients who may apply to him? ought he not rather flatly to refuse the performance of operations which are not indispensably necessary? On the other hand, does humanity permit us to condemn a patient always to bear an infirmity which renders his life miserable, simply because, in relieving him from it, we should expose him to dangers more or less serious? By this rule the surgeon ought never to touch LUPI, or tumors of any species which may develop themselves upon different points of the body, for they are rarely dangerous in themselves, and the operations which it is necessary to perform in order to remove them are sometimes attended with the most serious results, and occasionally produce the death of individuals the most robust, and apparently of the best constitution. I am far from wishing to justify those who hastily practise amputation of the members on occasions which do not absolutely demand it, for mere inconveniences, or solely because it is desired by the patient; but I ask if it is not conformable to the rules of sound surgery to have recourse to it for deformities which cannot be otherwise removed, and which are of such a nature as to destroy the natural use of an important part of the body, to cause pain, and to be a source of constraint and continual suffering; when also the patient is in favor of the operation, after having fully reflected upon the consequences which may result from his determination?

Art. 2.—Gun-shot Wounds.

No wounds so frequently call for amputation as those which are inflicted by fire-arms. Not that the projectiles impelled by gunpowder have in themselves any venomous property, as has been believed by some surgeons since the time of A. Ferri, and as is still imagined by the vulgar, but because they break, tear, and bruise the tissues which they penetrate or strike.

A bullet, a grenade, or a portion of a bomb, which carries away a part of the thickness of a limb comprising the vessels, demands amputation; while the same wound, produced by a cutting instrument, might perhaps be cured without thus mutilating the patient.

If such an agent strike the body of the arm or thigh in such a manner as to reduce the muscles to a jelly, but without affecting either the skin or the bones, it is still necessary to amputate, excepting in cases where the attrition is very limited, and the vascular and nervous trunks have escaped.

Wounds complicated with fracture also require this last resource. At the articulations, if the injury is considerable, there is no room for hesitation. There is no disagreement among practitioners upon this subject, excepting when the articulation is not too extensively opened, and the osseous extremities have simply been pierced or cracked by a ball. Here the surgeon takes account of circumstances. Is the patient in a situation to receive the necessary attentions? has the ball merely passed through the wrist, the elbow, the instep, the shoulder, &c., shattering the articular extremities without lacerating the tendons and other soft parts? The preservation of the limb should be attempted. But in the midst of camps and in crowded hospitals, when destructive epidemics are prevailing, and when the patient cannot obtain that calm repose and those assiduous cares which are indispensable, and if the fracture is accompanied by a splintering of the bone, if the ligaments, the synovial membranes, or the tendons are bruised and torn, amputation will be found more advantageous to the patient than delay. M. Labestide, it is true, desirous of sustaining the principles of Bilguer, has brought together in his thesis, a number of examples which prove that wounds of this kind, at the

wrist, the elbow, the foot, or the knee, have been cured without amputation. Several observations of a similar description have also been collected and published by M. Arnel from the practice of the hospital of St. Cloud, during the days of July. Faure, Percy, and Lombard, had previously mentioned similar facts. But how many cases of an opposite character may there not be opposed to these instances of unhoped for success? The gardener of the director of one of the theatres of the capital had a part of the metacarpus, and some of the fingers of the right hand carried away by the bursting of a gun; he was brought to the Hospital St. Antoine, where he earnestly entreated me not to sacrifice the remaining thumb and index finger. I gave way to his entreaties. Serious symptoms shortly appeared, and amputation of the arm, performed a fortnight after, failed to preserve his life. One of the individuals wounded in July, had the heel pierced by a ball and the tibio-tarsal articulation opened behind and outwardly. The injury not being of any great extent, M. Lisfranc and myself were desirous of preserving the member, but our patient expired on the eighteenth day. Another person who had received an extensive wound, with fracture of the elbow and opening of the joint, underwent no operation, and died, like the others, under the influence of the suppurative fever and *phlebitis*. A young man in my service had the heads of the bones and the articulation of the knee obliquely traversed by a ball, at the taking of the Hotel de Ville. There was no splintering nor any laceration of the soft parts: after a month's care it became necessary to amputate the thigh: this was done, but did not prevent the death of the patient, which took place on the thirteenth day after the operation. It is at least probable that amputation, practised at first, would have saved the lives of some of these patients.

It is not only about the complex articulations that wounds from fire-arms, with fracture or injury of the synovial cavities, are so dangerous; they are scarcely less so at the middle part of the long bones, particularly of the inferior members. Thus a simple ball, which shatters at the same time the *tibia* and the *fibula*, almost always calls for amputation. For one person who recovers without submitting to the operation there are ten who die, however trifling in extent may be the parts which have been injured or contused. At the femur, amputation is still more formally indicated. Ravaton says, that if amputation be neglected this fracture is almost always mortal. Schmucker says that not more than one patient out of seven can be saved by any other means. Lombard holds the same language. M. Ribes, who never saw a case of this kind cured otherwise than by amputation, gives the history of ten patients who died notwithstanding every care, and says that, at the Hospital of Invalids, out of a total of four thousand individuals he was not able to find one who had been cured of this species of wounds. M. Yvan, in 1815, calls the attention of M. Ribes to two cases of this description; but the patients retained fistulas, and eventually died in consequence of the fracture. I see that M. Gaulthier, of Claubry, formerly surgeon of the Imperial Guard, is of the same opinion as M. Ribes upon this subject; and says that those soldiers of the Spanish army, whose thighs were fractured and upon whom amputation was not immediately performed, almost invariably died. Out of eight subjects treated by Mr. Samuel Cooper, after the battle of Ondenbosh, only one survived, and even he was not able afterwards to make much use of his limb. Messrs. Percy, Tomson, Larrey, Guthrie, and J. Hennen, express themselves nearly in the same terms; and the events of July, 1830, have induced almost all the surgeons attached to the hospitals of Paris to adopt the same opinion. One of the individuals, however, who was wounded on that occasion, recovered under the treatment of M. Lisfranc, at La Pitie. M. Dupuytren saved

a second, and M. Arnel mentioned three others. I was not so fortunate: only one case of the kind called for my assistance; the fracture appeared quite simple, but nothing was able to prevent the death of the patient, which took place on the thirty-eighth day. M. Somme cured two out of eight without having recourse to amputation, during the events at Antwerp in Oct. 1830. M. Lassis, and other practitioners of Paris and Belgium, have also published several other successful cases; but it ought not to be forgotten that with us, as in Belgium, the wounded were treated with all that care which is usually experienced by patients in civil practice; whilst in the army and in military hospitals, they are necessarily deprived of that tender treatment which in the above-mentioned cities was so lavishly bestowed.

These successes besides were very few in number, and the member preserved generally continued in a deformed state, so that its loss could scarcely have been more disagreeable to the patient. It is necessary here to remark, that the fracture is so much the more dangerous as it approaches the middle of the bone, whether on account of the splinters which more frequently result at that part, or from the number, disposition, and force of the muscles. On the whole, amputation is the most frequently indicated in cases of comminuted fracture of the inferior members. Except in extreme cases, however, it may be frequently dispensed with upon the upper extremity. To distinguish at first sight the circumstances which demand amputation and those which enable the operator to dispense with it, is absolutely impossible. From the earliest ages wounds extremely trifling in appearance have been seen to become very serious, whilst on the other hand the most frightful injuries have sometimes passed away without any particular ill consequence.

It is doubtless painful to be obliged to mutilate a patient who desires to preserve his limb; but is the argument drawn from certain unexpected cures of subjects who have refused to submit to amputation, really entitled to the value which has been so generally accorded to it? Admitting that four out of ten individuals thus treated are cured, is it too much to presume that if they had all submitted to amputation, two-thirds of them would have recovered? I leave conscientious men to decide whether the lives of two or three men yet in the prime of their days, ought not to be preferred to the preservation of a deformed member to four persons at the price of a thousand dangers?

Preliminary Attentions.

Art. 1.—*Counter Indications*

To justify an amputation, it is not sufficient that the disease which requires it cannot be cured by any other means; it is also necessary that the operation should promise entirely to remove it, and leave a reasonable chance of preserving the life of the subject. When the operation is performed for a cancerous affection, the operator should assure himself that no germ of the disease exists in the viscera. If degenerated lymphatic ganglions are remarked at the root of the limbs; if the color of the skin, the state of the respiration, or of the digestion, or any, the least symptom, indicates that the affection is not confined to the exterior, amputation will be useless, and will only tend to hasten the development in more dangerous situations of diseases analagous to those which it is intended to cure. The same remarks apply to pulmonary phthisis; to the *necrosis* and caries of the vertebral column; to abscesses by congestion, the source of which cannot be stopped; to any organic

injury of the heart, of the liver, of the stomach, of the genito-urinary passage, &c.; to extreme exhaustion; to old and numerous ulcerations of the intestines, combined or not with a colliquative diarrhœa; in fact, to all those occasions when, after the removal of the limb, a disorder is left in the organization sufficiently serious to produce death. In rheumatic, scrofulous or syphilitic affections, it is much to be feared that the malady would speedily reproduce itself in other parts of the members, and would oblige the operator if he would pursue it to practice successively several amputations. It is necessary therefore in these cases to have at least many chances of being able to limit the progress of the general malady, even to cause it to retrograde, and at last to eradicate it entirely. Prudence does not permit us, for example, to amputate a member affected with caries or necrosis, scrofulous or syphilitic, if the articulations of any of the other parts are the seat of swellings, pain, or any of the first symptoms of a similar affection. In cases of scrofula, however, it has been for a long time remarked that the removal of an important member is frequently followed by an advantageous change in the constitution of the patient; that weakness is sometimes succeeded by appearances of strength and the most flourishing health. This effect is easily accounted for; an abundant suppuration, continued pain, and a diseased articulation, form a cause of disease which tends continually to deteriorate the functions, and cannot fail to keep up such a state of the economy as will prevent the development of the natural resources of the organization. By removing therefore this material cause of suffering and danger, it is obvious that the general health will be re-established; that ceasing to be obstructed or embarrassed in her efforts, nature will soon cause the disappearance of the lesser evils, and triumph over a malady the principal source of which has been destroyed. The first question to be decided is, whether disease really exists in the interior, and what is its nature? because if it be incurable, amputation is not admissible. The second relates to the source of the disease; as if it be in the external affection, amputation is formally indicated; if elsewhere, the reverse. Whenever the local affection is the result of a general cause, it is absolutely requisite to neutralize the first before proceeding to remove the second, sound practice not permitting amputation until this has been done. A minute examination of the patient is the more necessary before coming to a full decision, as the greater part of the diseases which require amputation rarely fail to react upon the splanchnic cavities, and to cause in the viscera either abscesses, or tubercles, or ulcers, or indurations; together with a thousand other morbid foci, the appreciation or discovery of which is far from being always easy.

It is nevertheless well to remark, that the weakness with which some patients are affected does not absolutely of itself forbid the operation. All practitioners know that it is not always with the strongest patients, or those who seem to have the best constitutions, that amputation most frequently succeeds. In fact, a certain degree of exhaustion, occasioned by long continued pain; even diarrhœa itself, when not kept up by any internal cause, are in general rather favorable to the operation than otherwise. It seems in the first case, that the organization enjoying perfect integrity revolts at the mutilation which is practised upon it; whilst in the second, the affection against which it has exhausted all its resources being removed, it has only to cause the disappearance of the secondary disorders which it had not been able to prevent.

Art. 2.—Time for the Operation.

During the last century the question was much agitated, whether, after se-

rious wounds by fire-arms or otherwise, it were best to amputate immediately or to wait for reaction. Faure, Boucher, Bilguer, Comte, and more particularly Schmucker, debated this point with great interest, on account of the wars which were about to take place; and although since that time it has continually occupied the attention of the surgical body, the problem still remains unsolved. The partisans of immediate amputation maintain that the subject is in the most proper state for the operation, immediately after having received the wound. There is then, say they, no fever, suppuration, or inflammation; the affection is wholly local, whilst at a later period, the swelling of the member, frequently gangrene, an intense reaction, tetanus, and a thousand other accidents, may bring on death before a proper moment can be found for the operation. Even when the violence of this reaction is calmed, say they, the abundance of the suppuration, the separation of the muscles, the fistulous passages which are formed, the induration and disorganization of the tissues, render the operation very serious and difficult. The partisans of consecutive amputation on the contrary, in order to justify their conduct, maintain that immediately after a wound the organization is too much disturbed, is under the influence of a too violent commotion, to permit the performance of any operation with a probability of success, and above all, that limbs are sometimes sacrificed which might otherwise have been preserved; whereas, after having combated the first symptoms, if amputation becomes inevitable, the surgeon is at least saved from reproach. Taken according to the letter, both these opinions appear equally contrary to sound practice. When amputation becomes absolutely indispensable, when there is no uncertainty upon this point, there can be no doubt that it is better to operate immediately than to make any delay; and Faure himself, who defended with so much ardor the cause of consecutive amputation, is also of this opinion. When on the contrary, there remains any possibility of preserving the limb, when its loss is not irrevocably decreed, the operator ought to temporize, to combat with energy the general symptoms, and also to decide upon amputation when there remains no hope of obtaining a cure by other means.

Upon looking closely at this matter, it is easy to discover that Faure has not placed it in its proper light. His ten wounded patients, it is true, had all fractures; the first, the ninth, and the tenth, at the leg; the second, at the femur; the third, at the knee; the fourth and fifth, at the fore-arm; the sixth, at the humerus; the seventh, at the metacarpus; and the eighth, at the heel; but none of these gun-shot wounds were so severe as to remove all hope of saving the part. In these cases the question might have been whether the operation was indispensable, but not whether it should have been performed sooner or later. The result to which this surgeon has given so much importance, does not in any way prove, that when the necessity of amputation has become apparent it would be less dangerous to practice it after than before the appearance of general symptoms. The very opposite conclusion might in fact be drawn from it. What did M. Faure gain by temporizing? Nine of his patients were obliged to submit to amputation after having endured five or six weeks of the most anxious uncertainty, and after having been in the greatest danger of losing their lives. To say that these patients if operated upon immediately would not have recovered, is to make a supposition wholly gratuitous. Reason tells us on the contrary, that these men who were able to resist so many causes of death, would have experienced a more perfect cure, and have been more fully restored to health, if, instead of being subjected to the temporizing practice of Faure, they had undergone immediate amputation.

In admitting that secondary amputations succeed better than those which

are practised immediately, the surgical academy is evidently wrong. To the calculations of Faure, which go to prove that the successes are as three to one, may be now opposed the experience of a host of respectable men who have observed precisely the contrary. M. Dubor affirms that during the American war in 1780, the French surgeons lost almost all their patients by deferring amputation, whilst the American practitioners, who performed the operation immediately, were successful in every case that they undertook. At the affair of Newburg, Percy was successful in eighty-six out of ninety-two immediate amputations. Out of fourteen M. Larrey saved twelve. Of sixty patients wounded in the naval engagement of 1st January, 1794, and who underwent immediate amputation, only eight died. After the battle of Aboukir, the eleven soldiers mentioned by M. Masclet, who were operated upon during the first twenty-four hours, recovered, whilst three others upon whom amputation was practised eight days later, died. The English surgeons inform us, that after the battle of Toulouse, immediate amputation was attended with success in thirty-seven cases out of forty-eight, and that twenty-one out of fifty-one died under a contrary practice. At the attack on New Orleans, the proportion was still more favorable; for out of forty-five immediate amputations only seven were unsuccessful, whilst by the other method only two out of seven were saved. It appears also, that M. del Signore, surgeon of the Egyptian army at the battle of Navarino, saved the whole of those patients upon whom he practised immediate amputation, but lost twenty-five out of thirty-eight of those upon whom the operation was delayed. Finally, the events of 1831 have further proved the advantages of immediate amputation. About one hundred operations were practised (thirty at the Hotel Dieu, fifteen at La Charite, twenty at the Gros-Caillou, thirteen at Beaujon, six or seven at St. Louis, four or five at the Maison de Sante, three at Necker, one at the School Hospital, one at St. Mery, and five at La Pitie), and in all these cases, the superiority of immediate over consecutive amputation was fully manifested.

The only question then is, whether amputation is or is not necessary; and the rules for deciding this point in each case, may be gathered from the chapter on the diagnostic, or on indications.

Amputation ought to be practised immediately, that is to say within the first twenty-four hours, before symptoms of reaction are developed; in short, as soon as possible, whenever there appears to be no chance of saving the patient otherwise. The stupor and numbness with which some subjects are affected, is not a formal counter-indication. A Swiss, whose thigh had been broken by a bullet, in July, and in whose case I had discountenanced amputation at *L'Hopital de Perfectionnement*, was operated upon by M. Guersent, jun., and recovered. Only those cases should be abandoned which appear to be beyond the reach of art. It is for the skillful practitioner to distinguish the circumstances which render a temporizing practice necessary. In doubtful cases he will wait, and combat or endeavor to prevent those symptoms which may manifest themselves. If afterwards amputation becomes indispensable, it should be observed that it will rarely be successful if practised during the *acute* stage of the symptoms, when the affection has not yet become wholly local, and while there are evident signs of *phlebitis* or of resorption. It is then that the viscera and their functions should be examined with the minutest care, as the reaction, which may appear to have subsided, frequently leaves purulent foci somewhere in the organization, which would not fail to compromise the success of the operation. These remarks are not confined to wounds inflicted by fire-arms, but are equally applicable to

injuries proceeding from other causes. Upon all points connected with this subject, I recommend to practitioners a reference to the excellent work of M. Gouraud (Principal Operator, Tours, 1815).

Art. 3.—Point of Amputation.

Amputations have been divided into two great classes: those which are practised upon the body of the limbs, bear the name of amputations in *continuity;* the others, which are only disarticulations, are entitled amputations in *contiguity*. Amputations are likewise practised at the point of *election* or at the point of *necessity*, according as the practitioner is at liberty, or is influenced by the wound or disease, to act upon one part in preference to another. Upon this subject it is scarcely possible to establish other than very vague rules; no rule, in fact, can be given which will not have numerous exceptions. Thus it would not be always correct to say that the operation should be performed as far as possible from the trunk, or that the most slender part of the member should be chosen.

The same remark applies to the rule which recommends that the amputation should always be practised above the injured tissues. The lardaceous degeneration does not in any way demand the removal of the affected parts, as it is sometimes advantageous to preserve them. It is commonly a symptom of an alteration of the hard parts, and will speedily disappear, the same as fistulous passages and the purulent sinus, when the cause which produced them has been destroyed. It is sufficient in such cases to divide the bone above its diseased parts, without being concerned at the state of the soft parts.

Art. 4.—Preparatives.

1st. The attentions, both physical and moral, which ought to be bestowed upon a patient; the preparations to which it is necessary to subject him before an amputation, are the same as for all other grave operations; the same as in the operation for aneurism, for example, and vary according to an infinity of circumstances. All times, all seasons, all hours of the day or night, may be adopted for the practice of amputating, as well as for all urgent operations. The morning, however, is generally preferred when a choice of time is given, as it is easier to watch the patient during the rest of the day, than if the operation were performed at the setting in of the night.

2d. A method of amputating without pain, has long been thought a desideratum. Theodore, and many others after him, have recommended to pass under the nose a sponge steeped in opium, water of nightshade, henbane, mandrake, lettuce, &c., previously prepared and dried in the sun, to throw the patient into a profound sleep; afterwards waking him by using in the same manner a sponge dipped in vinegar, or by putting the juice of fennel or rue into the nostrils or ears. Others, from the time of Guy of Chauliac, contented themselves, as has been subsequently practised, with administering opium internally. For a long time a strap, drawn tightly round the limb above the place where the flesh is divided, was believed to be the best means of preventing pain. Very recently Mr. Hirckmann, of London, has returned to the practice of the ancients; and maintains that it is possible to perform the most serious operations without pain, if the patient is made to inspire, or to take into his lungs in any way whatever a certain quantity of stupifying gas. Magnetism has not been forgotten; and all the journals of the day contained an account of an amputation of the breast, which had been performed

by M. J. Cloquet, without its being even perceived by the patient. Unfortunately all these means are dangerous, if not inefficacious. It is only by his address, his knowledge, and the skillful choice of instruments, that the surgeon ought to pretend to diminish or shorten the pain of amputation. It is much to be feared that the bistoury heated to the temperature of the body, as recommended by M. Guyot, will prove equally unsatisfactory with the means which have just been described.

3. *Apparatus.*—The instruments necessary for practising the most complicated amputations, are a tourniquet, a garot, a cushion with a handle, or other means of suspending for a time the circulation of the blood in the limb. Knives of different lengths, a straight bistoury, a convex bistoury, a saw with a change of blades, a dissecting forceps, scissors, curved or straight incisive nippers, hooks, suture needles, and a tenaculum. For the dressing are required single, double, triple, and quadruple waxed threads, cut into ligatures of different sizes and lengths; adhesive straps; lint raw, in balls and in pledgets; compresses, oblong, square, and of other shapes, together with bandages of linen and sometimes of woollen cloth. It is also necessary to have at hand agaric, sponges, warm and cold water in different vessels, a little wine, vinegar, and cologne water, a lighted candle, fire in a chafing dish, and in case they should be necessary, some cauterizing irons.

Among these instruments there are some that demand all the attention of the surgeon. The knives for example ought to be proportioned in length to the size of the member about to be amputated. Wiseman recommended that they should be made in the form of a sickle, in order to divide at once as much of the soft parts as possible. This description of instrument was generally adopted for upwards of a century, but has been completely out of use since the time of Louis, who proved its uselessness and its inconveniences. They are now made completely straight, terminating in a broad and blunt point. Others on the contrary are round at the extremity, whilst some are narrow and very pointed. This latter sort is preferred by M. Lisfranc. The best in my opinion, are those the edge of which is slightly convex, as recommended by Lassus. With regard to its length, it is between the knives adopted by the members or pupils of the old academy of surgery and those of M. Lisfranc. Without being too sharp their point is yet not cut square, and the heel is not required to form an angular projection in front of the handle.

The saw is an instrument which varies in shape still more than the knife. It should be so heavy as to require only to be drawn across the bone in order to its immediate action. Its blade should be properly set immediately before the operation, so as to present a greater degree of thickness towards the teeth, than towards the back; a width of cut sufficient to enable the blade freely, and easily to follow in the passage made by the teeth. This is effected by the care of the workman, in turning the teeth alternately to the right and to the left. Mr. Guthrie recommends that these teeth should be placed in two parallel rows, the points of one row being turned backward and the other forwards; by which means says he, the teeth will penetrate equally well, going and coming. This modification has not been adopted among us. It is necessary always to have one or two spare blades. This is a principle which F. de Hilden was induced to establish, in consequence of having been obliged upon one occasion to leave an amputation unfinished until he had procured another saw to replace one which had broken in his hand. The importance of this precaution must be manifest to every one. I shall return to the other parts of the apparatus, when speaking of their special application or of the particular amputations.

4th. *Position of the Patient.*—In the hospitals the patient is usually placed in the amphitheatre, or in a chamber particularly devoted to amputations. He is there laid upon a table more or less elevated, and furnished with matresses and the necessary linen. In certain cases he is simply seated in a chair, placed in a convenient position. Out of the public establishments a particular locality may be chosen, but in general the operation is performed upon a bed or chair in the bed-chamber of the patient.

5th. A particular duty ought to be carefully assigned to each of the assistants, before the operation. One of them is charged with the compression of the artery. For this purpose the individual who possesses the greatest strength, self-possession, and knowledge, is usually selected. A second embraces the member towards its root, in order to draw up the flesh; a third sustains and fixes the part which is to be removed; and a fourth is charged with the duty of presenting the instruments as they become necessary. Others are to hold those parts of the body, the movements of which might be injurious during the operation.

6th. *To suspend the Circulation of the Blood.*—Before carrying the knife through the living tissues, it is necessary, to guard against hemorrhage, to obstruct in some way the passage of the principal artery of the limb, until the amputation will permit the final obliteration of the vessels. For this purpose recourse was for a long time had to *circular compression.* This method was adopted by Avicenna, by the Greeks, and even still later by Pare. Some of the ancients, however, employed temporary hemostatic means, which were more efficacious. It appears, in fact, from the very vague notions which we possess respecting Archigenes, that that author even at that early period made use of the ligature, which he applied immediately upon the artery after having traversed the whole thickness of the part. By degrees the circular ligature was improved in the hands of the French surgeons. They began by removing it from the passage of the artery by means of a compress. In 1674, Morel transformed it into a true garot by the aid of a small piece of wood, which augmented or diminished at will the compression of the vessel during the operation. This garot, modified successively by Nuck, Verdue, and Lavauguyon, is still used; but to prevent the skin from being pinched, and to hinder as much as possible the compression of those parts in the circumference of the member which do not correspond to the artery, a compress several times doubled, a rolled bandage, or any other solid lump or pad is now previously placed over the vessel; whilst a plate of horn, slightly concave, is applied to the opposite side of the member below the part of the cord which is to be twisted. The *tourniquet* of J. L. Petit, invented towards the commencement of the last century, and of which several modifications have been proposed in England and Germany, has rendered the employment of the garot of Morel much less frequent. The instrument of Petit, in fact, is so disposed, that it acts with a certain degree of force only upon the passage of the vessels which are to be compressed, without hindering the circulation in the collateral branches. Besides, when once applied it may be left to itself, whilst the garot requires to be incessantly watched until the close of the operation. When the operator can only command a small number of assistants, or when those assistants have not sufficient knowledge to entitle them to full confidence, in the country, for example, and sometimes in the army, when unforeseen circumstances render the amputation of a member necessary, the garot, which can be fabricated immediately, forms an invaluable resource. The tourniquet of Petit, if it could be procured would be better; but in all other cases we should rely upon the hand of an assistant. When the artery is situ-

ated in a deep hollow, it is well to use a sort of desk-seat furnished with a cushion. In this manner the pain will be diminished, the retraction of the muscles not in any way hindered, and the operator will act freely and be able to approach the origin of the limb as nearly as the injury requires. In some rare cases, however, the operator has recourse to a surer method. He exposes the artery at a certain distance above the place where the amputation is to be performed, and applies the ligature. But this forms a special indication, and will be considered in the sequel.

SECTION III.

METHODS OF OPERATION.

A. Amputations in Continuity.

These were almost the only amputations practised during a long series of years, and are still more frequently practised than any others. They are performed in three different ways, but principally by the circular and flap methods.

Art. 1.—*Circular Method.*

In amputating by the circular method, the successive stages of the operation are—the division of the skin, the division of the muscles, the division of the bones, the prevention of hemorrhage, and the dressing of the wound.

§ 1. *Manual.*

1st. *Division of the Skin.*—Celsus, Archigenes, Gersdof, Theodoric, Wiseman, &c., in their day, as Louis, M. Dupuytren, and several others in ours, divided the skin and the muscles at the same stroke. It appears on the contrary, that Maggi dissected the skin at first to such an extent, as to enable him afterwards to cover the surface of the stump. But this method was never followed by the ancients, and it is to J. L. Petit that we owe its general introduction. That author, after having divided circularly the cutaneous envelope of the limb, caused it to be drawn up by an assistant, or drew it up himself to the extent of about two fingers' breadth. Cheselden pursued nearly the same method and at the same time; but Alanson seems to have been the first who recommended that the skin should be dissected and turned back so as to form a sort of ruffle, a practice which was afterwards adopted by Lassus, M. Richerand, and many other French surgeons. Messrs. Guthrie, Græfe, &c. think that the aponeurosis and some of the fleshy fibres might without inconvenience be divided on the same stroke; and that this would ensure the complete division of the skin, and enable that membrane to be more easily retracted. Hey and Langenbeck are of an opposite opinion. What advantage, in fact, can result from this careful tracing of the periphery of the muscles and the aponeurosis?—whether the knife penetrate a little more or less deeply. Provided the integuments are divided throughout their whole thickness, the remainder of the operation will not be rendered more difficult nor less so. The surgeons who, like Hey and M. Brunninghausen, desire that the skin should entirely cover the stump, have laid it down as a principle that the circumference of the limb should first be measured, so as to preserve, for example, two inches of the integuments for a wound which is to be four inches

broad. Lassus is said to have followed this direction with success. In my opinion, these minute precautions are altogether useless. The best method, when it is not intended to reach the bone at the first stroke, is to divide with the knife the different cellular fibrous bands which connect the exterior envelope to the subjacent parts, whilst an assistant draws it back with more or less force, as may be required. The pain is less, the skin preserves a greater thickness, and nothing can be more easy than to raise it in this way to the extent of two or three inches.

In order to make this division, the hand of the operator passes beneath the parts describing a segment of a circle, and applies the knife upon the anterior surface of the limb. It is useless here to follow the advice of Mynors, to incline the edge upward so as to divide the integuments bevel-wise. The incision should be made perpendicularly, the knife cutting from heel to point, and circumscribing the member in as regular a manner as possible. The hand is at first turned in pronation, and is gradually brought into supination as it passes first on the inside and afterwards beneath the member. If the operator desires to make this incision at once, the hand turns gradually upon the handle of the instrument in such a way as to be, at the end of the stroke, in a forced state of pronation. By this method he will avoid that disagreeable and fatiguing turn of the wrist which is experienced by the greater part of those surgeons who do not perform the incision at two separate movements. To a skillful practitioner it certainly would not be difficult to proceed as I have directed; but I do not see what great inconvenience there can be, after having divided the skin on the inside, on the outside, and beneath, in withdrawing the knife as it is done by many surgeons, and with much address by M. Blicke, of London, and carrying it above for the purpose of uniting, by a second incision, the two extremities of the first. This, however, evidently is matter of choice, and not of necessity.

2d. *Division of the Flesh.*—The section of the muscles seems to have particularly fixed the attention of surgeons for about a century past. From the time of Celsus the knife was carried a little above the dead parts, and the integuments, together with the entire thickness of the flesh, were divided at the first stroke. Celsus detached the deeper muscles and raised them in such a way as to be able to saw the bone a little further up, and bring them down again to cover the stump. This precept of Celsus has been long neglected, and Wiseman, J. L. Petit, and Cheselden, in making the section of the soft parts at two movements, seem also to have forgotten it. It was Louis who demonstrated that the conical figure of the stump, which was almost always left by the ancient methods, was owing to the retraction of the muscles more than to that of the skin, and consequently recommended that the muscular layers should be divided at two movements. At the first stroke Louis divided the integuments and the superficial muscles, which he caused to be drawn back as strongly as possible, favoring their retraction by all the means in his power; the deeper strata were divided by a second stroke, after which he sawed the bone in the ordinary manner. Le Dran says, "I cut at a single stroke the integuments and half the thickness of the muscles; then I cause the skin and flesh to be drawn back as much as possible, and then make a circular incision to the edge of the skin thus withdrawn; by this second stroke I do not cut the skin, but only the muscles down to the *periosteum*. This process is very similar to that of Pigray or Celsus, and differs very little from that of Louis. The latter author, however, deserves the credit of having improved it, and caused its importance to be generally admitted. Valentine, in his critical researches in surgery, imagined that it was necessary in dividing the

muscles to place them successively in a state of extension at the moment of incision; so that at the thigh, for example, the limb ought to be turned first backwards, then outwards, then forwards, and finally inwards, while the operator made the circuit of the member with the instrument. This odd idea never had, and never ought to have a partizan. Desault combined the methods of Petit and Louis, that is to say, he recommends with the first of these authors to divide and withdraw the skin in the first place; and with the second, to divide afterwards the superficial muscular stratum as far up as the skin was raised, and to commence the section of the muscles at the place to which the first layer retracted.

Alanson published, in 1784, a new method of performing amputations. After having dissected and turned back the skin, that surgeon divided all the muscles at one stroke, taking care to direct obliquely upwards the edge of his knife, and eventually to carry the point of his knife still more obliquely completely round the bone; his end being to obtain a hollow cone, the base of which would be at the circumference of the wound. Langenbeck combated this mode of practice, and Wardenburg attempts to prove that it is impossible to have a conical wound by following to the letter the directions of Alanson; "inasmuch as the knife," says he, "held obliquely, must necessarily describe a spiral and not a circular line." Lœfler and Loder, who undertook the defence of Alanson a short time afterwards, endeavored to prove, on the contrary, that it is not difficult to prevent this tendency to a spiral course. It appears that upon this point Messrs. Langenbeck, Græfe, &c., have misunderstood the process of the English surgeon. M. Dupuytren, in fact, who has adopted it for a considerable time, and subjected it to some important modifications, uses it daily at the Hotel Dieu with the greatest success. As the knife is penetrating, when it is directed obliquely it will be found sufficient to hold its handle in a proper position, to prevent it from straying from the circular direction. Alanson has also remarked that it is principally with the point of the knife that the operator is enabled to cut out a cone from the thickness of the muscles. In the process of M. Dupuytren, an assistant forcibly retracts the soft parts, whilst the operator, holding the knife as directed by Alanson, divides at a single stroke the skin and the entire thickness of the flesh; he then carries the instrument without changing his hold about the base of the fleshy cone, which rests upon the bone, in consequence of the retraction of the superficial muscles; this is done with extreme rapidity, and there results from it the appearance of a hollow cone very favorable to the reunion of the wound. Finally, Bell having divided the skin after the manner of J. L. Petit, and the muscles by the method of Wiseman, carries between them and the bone the amputating knife, in order to divide their adhesions to the extent of about two inches, and raise them afterwards with greater facility.

All the methods have undergone further modifications, which it is unnecessary here to mention. The brevity of the text of Celsus enables us to discover in that author the origin of the methods of Petit, Louis, Bell, and even that of M. Dupuytren. If it is doubtful whether at that time any surgeon had followed a method similar to those which are practised at the present day, it is not so with the method thus described by Pigray. "After having retracted the skin with both hands, the whole thickness of the flesh is to be divided around the limb, *above* the disease: then, with a cleft-bandage, the divided flesh is drawn back, in order to saw the bone as high up and as near to the flesh as possible. The hemorrhage being arrested by caustics, astringents, or a *ligature*, the skin is brought down and united in front of the wound, by

two stitches crossing each other. The most remarkable circumstance connected with these apparently different processes is, that, when closely examined they are for the most part seen to lead to the same results. Whether the operator incise at a first stroke the superficial muscles, and at a second the deeper layer, after the manner of Louis; whether he follow, on the contrary, the instructions of M. Dupuytren; whether he divide the soft parts at three strokes, as recommended by Desault, or whether he follow Alanson or Bell; if he but take the trouble to favor the retraction of the flesh, the bone will be exposed at two, three, or four inches above the point where the incision was commenced. In dividing the muscles therefore at the time of amputation, it is much less important to conform to any particular rule than is generally supposed. The method of Bell found, in 1829, a new defender in M. Hello, a naval surgeon, who recommends that it should always be used in preference to the formation of a hollow cone. From the trials that I have made of M. Bell's method, it certainly does appear to me that the muscles thus detached reapply themselves with greater facility, and are more easily put in contact, and maintained face to face from the bottom towards the edges of the wound than by any other method. It is only unfortunate that the operation is rendered by it a little longer and more difficult.

The most rational, sure, and generally applicable method is the following:—The skin is divided at a single stroke, without a too rigorous regard to the subjacent parts, and is drawn up by an assistant while the surgeon divides, to the extent of two or three fingers' breadth, the filaments which attach it to the aponeurosis or the muscles. Applied at the edge of the retracted skin, the knife divides circularly all the muscles down to the bone, or at least near enough to the bone to ensure the complete division of the superficial stratum. The assistant then forcibly retracts the parts, and by a second stroke the operator incises all the fleshy fibres of the profound *stratum* at the place where it begins to hide itself under the retracted extremities of the previously divided muscles. Whether the knife is held obliquely or perpendicularly is of no consequence to the definitive result; and whether the operator penetrates at first to the bone, or simply to the deep seated muscular *stratum*, is also almost the same. In both cases it is equally necessary to carry a second incision two or three inches above the first, through the most adherent muscular fibres.

3d. *Section of the Bones.*—The muscles having been divided, are drawn up by the aid of a retractor. For this purpose, woollen or linen bags, or plates of leather and even of metal were formerly used. F. de Hilden, Gooch, Bell, and Percy, praised these instruments; but surgeons of the present day are content with a simple cleft compress, the undivided part of which is laid upon the posterior part of the flesh rather than upon the anterior, as recommended by M. Græfe; its two free extremities are crossed and turned in front; and the assistant, who embraces the whole with his hands, thus draws back the soft parts in order to protect them from the action of the saw. Before proceeding farther, most surgeons recommend that the *periosteum* should be carefully divided and scraped away. Wiseman performed this denudation with the back of his amputating knife. Since his time, however, the bistoury or the edge of the ordinary knife has been preferred. Some practitioners, with M. Græfe, scrape downwards; others, with M. Brunninghausen, push the membrane upwards, in order afterwards to bring it down upon the track of the saw. These are all useless precautions, as has been proved by Messrs. Alanson, Guthrie, and Cooper, and before them, by J. L. Petit and Le Dran. They are recommended for the purpose of lessening pain, and preventing tetanus and the exfoliation and inflammation of the bone, together

with the suppuration of the surrounding parts; as if the *periosteum* could exert the slightest influence upon the production of such phenomena! When it has been carefully divided, one of two things must happen: 1st. The saw is carried a little higher than the denuded part without its being perceived by the operator, and then the scraping is of no effect. 2d. The saw is indeed applied upon the intended place, and in that case it is difficult to avoid leaving a small part deprived of its envelope, which circumstance will almost necessarily produce *necrosis*. On the whole, then, if the surgeon attains the proposed end the precaution is hurtful, and if he fails it is at best useless. We should then confine ourselves to detaching the fleshy fibres exactly, with the knife or bistoury. That done, the operator embraces the member with the left hand, placing the thumb immediately above or below the point which is to sustain the action of the instrument. The saw, held in the right hand, is applied perpendicularly and moved rapidly to and fro with short strokes until a way is made; afterwards it is drawn from heel to point, and pressed very lightly. Whilst there is yet considerable portion of bone to be traversed by the saw the operator may proceed quickly, but when he approaches the end of the division he must observe the greatest caution. At this period the assistants also should redouble their care to maintain the opposite parts of the member in their natural direction. If the assistant who holds the diseased part lower it, the bone will inevitably break before it has been entirely divided; if he raise it, on the contrary, the action of the saw will be impeded and the operation thus rendered more difficult. It is necessary also, that the operator should be habituated to the use of the instrument, and that in sawing he should be careful not to incline it either to one side or the other. With attention to these instructions the bone will generally be cleanly divided. But if any points or asperities remain at its extremity, they should be immediately removed either with incisive pincers, which are generally used, with a small saw, which appears to me to be the best instrument or, when they are sufficiently long, with the same saw which has been used for the amputation. The edges of the section are usually so sharp that some surgeons, such as Messrs. Græfe and Hutchinson, have recommended that they should be rounded with a file or with the edge of a short and firm scalpel. This practice, however, is not imitated by other surgeons; both theory and observation unite in demonstrating its inutility.

4. *Hæmostasis.*—Immediately after the section of the bone, the operator removes the cleft compress and proceeds to close the vessels.

A. *Topicals.*—We do not now, as in the time of Paul of Egina, *cauterize* the wound with a hot iron, boiling oil, or melted lead; nor stuff it with oakum or plasters smeared or saturated with the white of eggs, bole armenic, or other astringents, used by Guy of Chauliac, and almost all the surgeons of the middle ages; nor have we recourse to arsenic, vitriol, or alum, still more lately recommended by Lavauguyon and Le Dran; nor, finally, employ the sponge, or agaric of the oak, as was proposed by Brossard and Morand towards the middle of the last century. M. Binelli, however, says, that with a water of his invention it is easy to arrest every kind of hemorrhage; and several experiments seem, in fact, to support his assertion. M. Bonafoux composes with charcoal, gum, and colophony, a powder which he recommends as possessing the same properties. Finally, Messrs. Talrich and Grand have discovered a liquid, the efficacy of which has been put out of doubt by numerous experiments upon dogs, sheep, horses, &c.; but application of these novel means having never yet been made upon the human subject, I abstain from any further discussion of them.

B. *The ligature* is justly preferred. Pare is the author of this important modification. If Galen, Avicenna, Tagault, and some others, had already mentioned it, it must be confessed that it was without advantage to the practice of surgery. F. de Hilden, Wiseman, Dionis, and De la Motte, who speedily adopted it, were not long in causing its general dissemination, and now for a long time it is only by way of exception that it is ever neglected, or that other means are substituted in its place. The operator commences with the principal artery, inasmuch as it is more easily found than any other, is more necessary to be obliterated, and because the other arteries will also afterwards be discovered with less difficulty on account of the greater quantity of blood which will be conveyed to them. The principal artery then is taken up with pincers, embracing its whole thickness, but carefully avoiding the nerve and vein. Some practitioners, Desault, Hey, &c., have however recommended, at least for the great trunks, that the operator should reach and tie at the same time the deep artery and vein, by directing one of the branches of the pincers into the mouth of each. They intended by this means to guard against hemorrhages which might arise from the great veins. The moderns reject this practice; first, as useless, and afterwards as dangerous; useless, because the concentric circulation of the veins does not permit the blood to escape by their mouths into the body of the stump, and because even if that accident happen it is not necessary to have recourse to the ligature; dangerous, because, say they, in strangling a great vein the operator runs the risk of producing inflammation in its coats. As to the ligature of the nervous cords, that is a practice which all agree in discountenancing. Instead of pincers, Bromfield, and the greater part of English surgeons make use of the tenaculum; but this instrument, although it renders the application of the thread more sure and easy, is not so convenient as the pincers for seizing the vein and drawing it out without laceration; this is no doubt the reason why the *tenaculum* is rarely used in France. But whichever may be used, when once the artery has been seized the operator endeavors to bring it out from the surface of the wound; an assistant then passes a thread beneath it, bringing the ends together above so as to form a loop, which he passes beyond the end of the pincers: these are then turned horizontally. It is tightened by seizing its extremities with the last fingers of both hands, and drawing them upwards, while with the fore-fingers and thumbs the knot is pressed as deeply as possible into the wound. Some persons, according to the advice of M. Richerand, prefer pulling upon the thread in such a way as to draw the extremities backwards, beyond the place where the artery is found. If the vessel is found at the bottom of an excavation, the same end will be attained by holding the ligature away from the knot on each side with the fore-fingers, which there represent a sort of pulley. All these rules, however, are unnecessary to a surgeon of any intelligence; every such practitioner will adopt that method which appears to him the most convenient and the most safe. The principal artery being closed, the others are carefully sought for and successively obliterated in the same manner, except that it is unnecessary to isolate them so exactly from the small veins and other tissues which surround them.

Single threads are employed for vessels of the second or third order, and double or triple ones for the great trunks. In England, where fine ligatures have been generally adopted in the treatment of aneurisms, double and triple threads are no longer used after amputations. The principal artery is sometimes so hard, and encrusted with phosphate of lime, as to crack like glass under the application of the ligature; in these cases a small cone of linen,

cork, elastic gum, or any other similar substance, should be introduced within it; or a small cylinder, like to that which is called *Scarpa's roll*, should be placed between the artery and the ligature, which ought to be larger than those used for healthy trunks. Finally, it has been thought by some that simply flattening the vessel would be a sufficient precaution against hemorrhage.

Sometimes the blood escapes from the interior of the bone, either by transudation or from the trunk of its proper artery. A small graduated compress applied upon the place from which the blood issues, whilst the operator seeks the other vessels, will usually, says Mr. Ramsden, be found sufficient to arrest this hemorrhage; otherwise it would be necessary to have recourse to cauterization, or to place a morsel of wax, or plugs of lint or agaric in the medullary canal. A great number of arterial branches may be seen during this operation which cannot be found immediately afterwards, and which sometimes a little later cause a very abundant flow of blood. This phenomenon is explained in a way which appears to me any thing but satisfactory. I do not see why the momentary absence of hemorrhage should be attributed to spasm of the divided arteries, to their retraction, or to the instantaneous action which the air exercises upon them. If they seem to reopen at the expiration of a few hours, that circumstance is evidently produced by the concentric determination of the organic actions consequent upon the operation, which afterwards gives place to an eccentric movement—a reaction more or less lively, which carries the fluids back from the interior towards the exterior. The practice followed, first by Parrish, in America, by Klein, in Germany, by several surgeons in England, and even by Messrs. Dupuytren and Lisfranc, in France, of *leaving the wound open for several hours* in order to give time to the lesser arterial branches to return to their natural state, does not appear to be in accordance with reason, and I believe I may permit myself to condemn it as a general method.

Since immediate reunion after amputation has been proposed and followed by a great number of practitioners, there has been an endeavor to leave as few foreign bodies in the wound as possible. They begin by *cutting one of the ends of each ligature* very near to the artery. M. Weitch, who believed himself the inventor of this modification, insisted strongly, in 1806, upon the advantages which resulted from it. He employed then, as has since been recommended, very fine silk threads, in order to be able to cut both extremities and leave the knot about the artery. Drs. Haire, Wilson, Belcombe, Maxwell, Hennen, &c. had followed this practice long before it was mentioned by Mr. Lawrence. Messrs. Collier, S. Cooper, and Delpech, have also tried it with success; nevertheless, Messrs. Cross, Dauning, Guthrie, &c. have remarked that these ligatures frequently produced secondary abscesses. It appears, moreover, from the researches of Messrs. Hennen and Carwardine, that this practice of cutting the ends of the ligature very close to the knot, was followed in different countries of Europe from the year 1780. As it appeared that thread or silk could not be absorbed, but acted always as foreign bodies, ligatures formed of other substances were introduced. Ruysch had already proposed broad strips of leather, the use of which Beclard has revived in France. In America, Dr. Physick tried ligatures of deer-skin. These latter are much praised by Dr. Jameson, who has long employed them. Others have had recourse to catgut, &c., and to the intestines of silk worms; but experience has not yet pronounced upon the real and definitive merit of these different substances. Ligatures of thread, single or double, according to the volume of the artery, are generally used in Paris. When they have

been applied, and before proceeding to the dressing, one of the ends is cut very near to the vessel, in order to diminish the mass which they form in the midst of the tissues; the other extremity remains on the outside of the wound, and serves to withdraw the knot when it has become detached from the artery.

C. *Compression.*—M. Koch, surgeon of the hospital of Munich, affirms that for more than twenty years he has not in any case had recourse to the ligature after amputation. He confines himself to compressing the principal artery of the member by means of graduated compresses, and a rolled bandage extending from the trunk almost to the wound, which he unites immediately. Numerous facts, he says, support this practice, and prove that it is not necessary to tie the arteries in order to prevent the passage of the blood to the surface of the stump. A question of a serious nature seems to me to be at the bottom of these assertions. The annals of science contain facts without number, which prove that the most voluminous arteries may be divided without giving rise to any effusion of blood. Every one knows that lacerated wounds, amputations after gangrene, and wounds by fire-arms, have often astonished practitioners in this particular. S. Wood had the shoulder torn off by the wheel of a mill, and was cured without an artery being tied. De la Motte, Carmichael, Dorsey, and Mussey, each report a similar case. A child nine years of age, mentioned by Benomont, had its leg torn off, and was cured in the same manner. In another case, the thigh, violently separated from the haunch, was unattended by any flow of blood. The amputation of the thigh related by Tcheps, Scharschmidt, Theden, Thomson, Messrs. Taxil, S. Cooper, Beauchene, Segond, Labesse, presented the same phenomenon. Messrs. Arbe, Lizars, Mudie, Smith, and Flandin, mention several amputations of the leg, arm, fore-arm, &c., which were attended with similar results; and I have myself witnessed several cases of the same description.*

The researches which I have made upon this point of practice, have led me into several experiments the principal results of which are here detailed:—

D. *Bruising.*—Bruising is rarely sufficient, except for small arteries; if those who practise it after having cut or torn the cord of newly-born infants; if the animals who effect it by chewing the umbilical cord of their young, succeed thus in preventing hemorrhage, it is because the circulation generally ceases of itself in the umbilical vessels after birth. Nevertheless, after having employed it successfully upon the epigastric artery and those of the leg and fore-arm, I can conceive that Le Dran may have contented himself with this practice after dividing the seminal cord of man.

E. *Plugging.*—A cone of alum or sulphate of iron, about three times in length, placed in the crural artery and even in the carotid of a cat or dog, fixes itself promptly, and is generally sufficient to arrest the effusion of blood; but the species of eschar which results from it preventing immediate reunion, it is possible that the blood may re-appear at the coming away of this foreign body; it should be added too, that its introduction is not always easy except in the great arteries. Wax produces the same effects, but being more slippery and exerting no chemical action upon the vessel, it requires to be thrust in more deeply: nevertheless, if when it is introduced the operator pushes it downwards with pincers or with the fingers through the walls of the vascular tube, the extremity of which he at the same time holds firmly closed, there will be formed a sort of knot, which the blood will have some difficulty in removing. The stylet which Chastanet seems to have used long since for

* Journal Hebdomadaire, 1830-1831.

the same purpose, though less sure, yet quite frequently effects the obliteration of the artery. The point of a bougie is far better, at least whenever it is made to penetrate not less than an inch. Catgut, deer skin, or chamois leather, being scarcely foreign bodies, offer still greater advantages, in consequence of their presenting no obstruction to the immediate closure of the wound. These different substances form a species of cork, the manner of using which is too simple to require a particular explanation. M. Miquel, of Amboise, made similar observations at the close of the year 1828. I have incontestably proved, says he, by thirteen experiments, that by introducing into the arteries of a dog a foreign body, particularly an instrumental cord, a morbid state is speedily and invariably produced, which renders them incapable of receiving the blood, although they may not be mechanically obliterated.

F. *Folding back.*—When it is not too difficult to isolate the artery in order to fold it upon itself, as was practised by Theden upon the intercostal, and by Le Dran upon the whole of the cord, after castration, this method will almost invariably stop the flow of blood. To do this it is sufficient to bend back the extremity of the vessel, to double it, and to push it a little way into the flesh, or to close the wound immediately over it, in order to maintain the artery in the position that has been given to it. A branch of the external *mammary* and two branches of the subscapulars, thus treated in the month of August, 1828, at the hospital of the school of medicine, in the case of a female upon whom I had operated for an enormous tumor at the left arm-pit, were unattended with the slighest flow of blood. The same is true of an aged woman whom I relieved from a cancer in the breast, towards the termination of the year 1829, at the Hospital St. Antoine; and of a third patient in the month of January, 1830, in whose case I was obliged to remove the first metacarpal bone. As it is possible, however, that without this doubling the flow of blood might have ceased, prudence recommends delay in coming to a conclusion, notwithstanding the authority of Mr. Guthrie, who, after having said that the slightest pressure exercised with the extremity of the fore-finger suffices to arrest hemorrhage, adds: "If the orifice of the artery, whether by the effect of a natural curvature of the vessel or by accident, retracts or turns to one side in such a way as to put itself in contact with a somewhat solid muscular surface, that simple contact will prevent any escape of blood.

G. *The perpendicular compression,* which J. L. Petit endeavored to introduce during the last century, has not been adopted. By directing plugs of linen, agaric, sponge, or lint, upon the arteries at the bottom of the wound, with the assistance of a machine, we should but aggravate the usual results of the operation, without being sure of preventing hemorrhage. Even in his famous case of the Marquis of Roquelin, Petit would have done better in exposing the principal arterial trunk of the limb above the solution of continuity, than in proceeding as he did upon that occasion.

Sometimes the arteries are so deeply hidden in the flesh after amputation, that it is impossible to seize or take them up with either tenaculum or pincers. On these occasions, if they are at all events to be tied, a thread must be passed round them by means of a suture needle, at the risk of embracing more or less of the circumjacent tissues.

7. *Torsion.*—A question completely novel, as it springs from the experiments before referred to, is that of torsion, as a substitute for ligature after amputation. I was conducted to this discovery, in 1826, while putting to the proof upon dogs the various known means of preventing hemorrhage. I had never tried it upon man, and had not sufficiently varied my experiments upon animals to permit myself to speak upon the subject, except to the students

who attended my lectures upon surgery, at the close of the year 1827. But on the 13th November, 1828, after having amputated the arm of the girl Rohan, in the presence of Messrs. Al. Dubois and Malteste, I twisted the radial and ulnar arteries, doubled back the anterior interosseal, and immediately closed the wound. No hemorrhage resulted, and a cure was effected in twenty-three days. On the 4th December following, I followed the same mode of procedure and with similar success, after the amputation of the first metatarsal bone. The patient was a strong and vigorous male adult. It was not however until the 21st September, 1829, that I practised amputation of the thigh without ligatures. I had to twist only the crural artery, and two small muscular branches. *No hemorrhage followed.* The young girl, nineteen years of age, who did well until the fourth day, died on the twelfth. An examination of the body discovered several purulent and tuberculous collections in the lungs. The articulation of the hip was in the height of suppuration. Some days later, the 26th of the same month, I did nearly the same, after amputating the arm of a young man twenty-three years of age. The humeral artery, the great anastomotic, and two branches of the external collateral, were twisted without difficulty, but several other branches offered greater resistance. Seeing, at the expiration of a quarter of an hour, that in spite of the tourniquet the blood continued to flow, I removed the dressings. Nothing flowed from the twisted arteries. The hemorrhage proceeded from those which had been bruised, and from three others which I had not at first perceived. I tied them all, and the blood did not re-appear. The patient died on the sixth day, and the examination of the corpse discovered no other lesion than a deep disease of the scapulo-humeral articulation. The vessels both arterial and venous, presented no trace of inflammation, and the arterial extremities, firmly closed, were in both these cases lost, as it were, in the midst of the other tissues.

I became from this time convinced that torsion would succeed as well upon the arteries of man as upon those of dogs, and that in cases of necessity it would be possible to use it instead of the ligature. It remains to be seen whether it is better and ought to be preferred to the latter. The experiments of M. Thierry, who was unacquainted with mine first made upon horses, and commencing at the beginning of July, 1829; those that M. Amussat made known to the academy on the 15th of the same month, three years after my first attempts, and which he has so frequently repeated since; those of Messrs. Lieber, Kluge, Schrader, Tyro, Reigner, and Dard, upon animals; of Blandin, Roux, Ansiaux, Fricke, Dieffenbach, Rust, Fourcade and Bedor, Lallemand and Delpech, Guerin, Jobert, and Key, upon the human subject, without definitively deciding this question, are sufficiently numerous to render its solution probable.

Modes of Operation.—Like every thing else which depends upon the hands of men, the manner of twisting the arteries will vary according to the ideas or caprices of each practitioner.

1. M. Thierry, who recommends that it should be done parallel with the axis of the vessel, contents himself with seizing the divided tube by its extremity with Percy's pincers, or rather with pincers the chaps of which should be larger or smaller according to the calibre of the artery, and turns it upon itself from four to eight or ten times, without fixing the base.

2. In Germany several other modifications have been already proposed. M. Kluge, for example, boasts much of an instrument of his invention, which by unloosing a spring, causes the pincers to turn upon themselves.

3. For my own part I use any kind of grooved pincers, or even the ordinary ligature pincers. After having seized with this instrument the vessel at its extremity, I isolate it from the surrounding tissues, and then seize it towards

its root at the bottom of the wound with another pair of pincers, so as to fix it, or perhaps with the thumb and fore-finger, whilst with the first pincers I turn it upon its axis from three to eight times, and not three times only for the great arteries, as I have been erroneously made to say.

4. M. Amussat recommends that the artery should be seized with pincers having round branches, and drawn out some lines from the bleeding surface; that after it has been carefully isolated from the veins, the nervous filaments, and all the tissues which surround it, the blood which it contains should be crowded back, and that it should be fixed towards its root with a second pair of pincers, whilst the first pair break by gentle movements the internal and middle tunics; that the extremity of the artery should then be twisted somewhat rapidly from six to ten times at the same time that the stationary pincers fix it, without pressing it too much towards the flesh, and that as soon as the rupture of the inner membranes has been accomplished, they should be crowded back in the direction of the heart, by acting through the cellular tunic as I have described under the article aneurism. Instead of pushing back and leaving the isolated part of the artery at the bottom of the wound, the operator may continue to twist it until he detaches it completely, and leave only a sort of gimlet point in the middle of the wound. "Nevertheless, it must be acknowledged," says M. Vilardebo, from whom I borrow these details, "that these manœuvres are more easily executed when the torsion is limited by the fingers than when the operator makes use of two instruments. The second pincers are only useful in fraying the artery and crowding back the broken coats. After this, the thumb and the index finger of the left hand seize the extremity of the vessel at the point beyond which the inner coats have been pushed, and makes first several turns with the pincers, to which the operator afterwards approaches the fingers and continues the twisting a moment longer; he seizes the artery still nearer and nearer to the instrument, always continuing the torsion, and so on till the fingers meet the instrument. The operation is terminated by rolling the spiral thus formed into the shape of a cork-screw, and by pushing it into the depth of the parts."

Remarks.—Two things require to be separately considered in this process, 1st, the isolation, and 2dly, the torsion of the vessel. The first, which applies equally to the ligature and to torsion, is incomparably the most difficult and the most complicated. Although the great arteries, surrounded by healthy tissues, flexible and elastic themselves and free from disease—all those which are seated in the muscular or cellular interstices, may be easily enough taken up, divested of the surrounding lamellæ, lengthened and drawn out several lines—it is far from being so with those which creep along in the thickness of some of the tendons or of voluminous nerves, and which adhere by their circumference or their external surface to the fatty *strata* that envelope them; which are fragile, scarcely perceptible, crushed by the least pressure, and which one is afraid to let go when they have once been seized. If it were absolutely necessary, the operator might doubtless reach them in the majority of cases with time, address, and precaution. But what benefit would result from this? It is an error which has been a hundred times demonstrated, to believe that it is dangerous to comprise a few *lamellæ* of the cellular tissue, or fleshy fibres in the ligature at the same time with the artery. Nervous filaments, and even small veins intercepted in this manner, do not in reality give rise to any other inconvenience than that of causing for the time a slight increase of pain. One must be a stranger to the habitual practice of the great hospitals, to charge to imperfect isolation of the arteries the accidents which so frequently follow amputation. So that it is only in applying torsion, that these preliminaries are

indispensable; from which it follows, let us say at once, that as regards execution the ligature will always have the advantage. Happily, we may safely neglect a part of the instructions, given by M. Amussat. In following them to the letter, M. Jobert saw the hemorrhage reappear by the twisted arteries. Mr. Fricke, who follows almost the same method as myself; Messrs. Dieffenbach, Rust, &c., who have only partially adopted these instructions, have rarely observed the same inconvenience. It is not because I have continued to employ my own mode of procedure that the torsion has sometimes miscarried in my hands. Wherever the vessel was easily taken up, caused to project, fixed behind with other pincers or with the pulp of the two fingers, the obliteration was perfect, although I might not have thought it necessary to isolate it farther. For the rest, this difficulty is the only one, so far that I know to be connected with torsion. When the favorable conditions which I have mentioned above manifest themselves, and the practitioner gives the necessary attention to the operation, the arteries will be as firmly closed as if they had been tied. The inflammation and suppuration, whether external or internal, of the vascular and nervous fasciculus, do not appear to be more likely to occur after torsion than under the influence of the ligature, except perhaps when the torsion is practised with a simple pair of pincers, and without taking the precaution to limit its extent towards the heart, as in the process of M. Thierry, for example. At least there is nothing in the facts published at Berlin, at Hamburgh, and at Paris, together with those which have come under my own observation, to show that the fears of the professor of Montpellier have any foundation. The reproach which has been thrown upon torsion of leaving a piece of the artery to act as a foreign body in the wound, appears to me without foundation. In the two subjects operated upon by me at the Hospital St. Antoine, this vascular stump, still distinguishable, was firmly united with the surrounding tissues so as to give no further trouble, and I have never heard that other practitioners have shown this circumstance to have an injurious tendency. Thus, the only undeniable defects of torsion are that it does not always offer so much security as the ligature; that it is not applicable in all cases; that it requires considerable skill and practice to execute it properly; and that it renders the operation longer and more fatiguing. On the hand, by leaving no foreign body in the wound, it offers the great advantage of favoring immediate union, of offering no irritation to the bleeding surface, and of helping us to bring about a cure without suppuration. In this respect, however, the attempt of the operator will scarcely be satisfactory. The patients of M. Amussat, with the exception of a child who recovered at the end of twelve or fifteen days, were not cured sooner than they would have been by the use of the ligature. Union strictly by the first intention has not been obtained by Messrs. Fricke, at the Hamburgh Hospital; Ansiaux, at the Liege Hospital; Dieffenbach and Rust, at the Berlin Hospital; Guerrin, at Paris; Bedor and Fourcade, at the Troyes Hospital; Lallemand and Delpech, at the Montpellier *Clinique*, nor by Key, at Guy's Hospital, in any cases of amputation whatever. This being the case, torsion has no real claim to preference except in some operations which are practised upon the soft parts alone. In fact, ligatures well applied, can always be removed at the sixth or twelfth day; and a host of facts prove, that after their removal, eight or fifteen days, and sometimes less, suffice to complete the cure. And we cannot see how an extensive wound, comprising bone, muscle, aponeurosis, so many different tissues through the whole thickness of a limb, can be fully cicatrized, firmly united in less than twelve or twenty days. On the whole, I believe that after

amputations it is useless to be at much pains in twisting those arteries which present any difficulties in the way of torsion; but that it would be better to tie them at once, leaving to torsion in such cases the rank of an exceptionary method.*

§ 2. *Dressing.*

There are two general methods of treating the wound resulting from amputation; sometimes the lips are united as exactly as possible, and the most perfect contact is aimed at. Sometimes, on the contrary, they are kept apart by placing between them foreign bodies and several pieces of dressing. In the first case the operator seeks to obtain what is called *immediate union*, or by *first intention;* in the second, suppuration is favored, and the cure or cicatrization is only obtained *mediately* or by *second intention.*

A. *Mediate Reunion.*—Until the end of the last century surgical writers speak only of mediate reunion after circular amputation, but the operation was far from being always performed upon these principles.

The ancients were in the habit of filling the wound with compresses or sponges dipped in vinegar; treating it in all respects like all other solutions of continuity in which they wished to bring about suppuration. Those who, like Archigenes, Heliodorus, Paul of Egina, &c., had recourse to cautery to suspend the hemorrhage, made use at first of garlic and salt to cause the separation of the eschar, and afterwards of cataplasms of honey, meal, eggs or simply of emollient substances. The Arabs have particularly vaunted the use of astringents, styptics, and bole armenic; they also frequently employed the balm of sulphur. F. de Hilden thought to simplify the dressing by enveloping the stump in a woollen bag stuffed with different substances. Wiseman preferred Fabricius' bag—the bladder of an ox. He employed also the dry suture to bring the lips of the wound a little nearer together. Sharp wished to discard the hot iron; but in order to hinder the soft parts from retracting, he had recourse, like Pigray, to two ligatures crossing each other in front of the stump. This was the progress to the mode which was generally followed towards the close of the last century. At the present day it is practised in the following manner:—Some practitioners bring together the ligatures into a cord at the most depending part of the wound; and after having enclosed them in a simple compress, cause them to be held there by an assistant. Others cut both extremities close to the knot. Some bring them out separately, and fix them by as many small morsels of diachylon upon the corresponding points of the skin. Afterwards, a fine linen cloth covered with cerate, and pierced full of holes, is placed over the whole extent of the bleeding surface; the edges of which are brought more or less forward, so as to form a large hollow. This hollow is filled with picked lint, some regular bats are placed above, two rather long compresses dispersed cross-wise should embrace the whole extent of the stump, whilst a third envelops the circumference: a bandage of convenient breadth and length then keeps the whole in place. Instead of applying a piece of fine linen immediately upon the wound, as was done by Messrs. Boyer and Roux, and many others, some

* Although I employed myself on the subject of torsion, and experimented upon and proposed it a long time since (1826), yet, when M. Amussat also made it the object of his researches in 1829, I at first kept silence, hoping that that gentleman would arrive at results completely conclusive; now, however, as the opinions which I had then, and which I have just now advanced, seem to flow naturally from all the works published upon the subject, I deem myself authorized to promulgate it here without reserve; entreating the reader not to confound that exposition with the extravagant hopes which this hemostatic resource has excited in the minds of some persons.

surgeons still pursue the method of the past age, and fill the solution of continuity with sponge, agaric, or lint, but surround the circumference with a fillet or band of linen cut into points upon its external edge, and smeared with cerate. The compress, pierced with holes, appears to me preferable. The latter is easily turned over the edges of the wound, and there is no fear of the lint or other parts of the dressing, contracting adhesions with the living parts which have been divided. Finally, the second dressing may be performed without pain, and with the greatest facility whenever the operator judges it advisable. The cross of Malta, formerly in general use, has given place to the oblong compresses, which are more easily applied and more easily adapted to the forms of the different stumps. The operator must be careful not to push them too forcibly towards the root of the member, for he would not fail to crowd back the muscles and the skin, the retraction of which it is necessary rather to check than to favor. It is for the purpose of avoiding this retraction, and diminishing as much as possible the projection of the bone which results from it, that Wiseman, and more particularly Louis, recommends the application of the confining bandage from above downwards, and not from below upward. In this particular I cannot too strongly recommend the method followed by M. Richerand. The bandage is passed at first once or twice round the trunk, it is then directed upon the root of the member and brought by successive turns, moderately tight, to the level of the end of the bone. The remainder of the dressing is conducted in the manner just described. A new bandage, or the remainder of the first, serves to fix the compresses by a second set of turns, and to maintain the whole in place. By this means the muscles are prevented from easily retracting; the skin is pushed forwards, and this method will moreover in a great measure prevent the swelling of the stump, the erysipelatous or phlegmonous inflammations of which it often becomes the seat, and even *phlebitis*, which it is so necessary to combat from the moment that it seems disposed to make its appearance.

B. *Immediate Union.*—The method of bringing together the edges of the wound, of immediately closing it, does not appear to me to have originated earlier than the time of Alanson, or at the farthest than that of Gersdorf. It was followed by Hay, and shortly afterwards by almost all the surgeons of Great Britain; but it was viewed amongst us with a certain degree of repugnance, except by Percy, who had occasion to use it frequently and to prove its utility in the midst of camps. Pelletan, M. Larrey, &c. at first strongly opposed it; but Messrs. Dubois, Richerand, Roux, Boyer, Dupuytren, Delpech, and almost all the distinguished practitioners of Paris and the other cities of France, concluded by adopting it in most cases. It appears, however, that at the Hotel Dieu M. Dupuytren has found occasion to be less satisfied with it than at first; that at La Charite M. Roux believed it his duty to limit its application, and M. Lisfranc seldom makes use of it at La Pitie.

To unite by first intention, it is still more necessary than by the other method that no foreign bodies should be left in the wound which it is possible to extract. The operator begins therefore by carefully removing the clots and the threads which are not indispensable, cleansing the surrounding parts with a sponge, and by drying the whole with a soft linen cloth. This done, he brings together as exactly as possible the divided parts, taking care to leave no greater space between them at the bottom than at the edges of the wound. While an assistant holds the parts in this state, the operator applies the adhesive straps. By commencing with those of the middle, it will in general be found more easy afterwards to apply the others. Three or four are generally sufficient. It is a rule to leave a free space between them,

instead of covering the whole of the stump. The longer they are, all other things being equal, the better they will hold, the less they fatigue the skin, and the more perfectly they will attain the end proposed. To sustain their action it is often useful to confine at the same time upon the sides of the wound, parallel to its greatest diameter, graduated compresses more or less thick, or rolls of lint, either between the straps and the skin, or between the bandage and the straps. This is the only way in most cases to prevent the accumulation of fluids at the bottom of the wound, and to obtain a fair and regular union.

If the threads have not been cut near the arteries, the operator brings them out separately, and fixes them between the emplastic straps by means of small ligature compresses.

Instead of the pinked bandage, or the pierced compress placed over the whole anterior surface of the stump, some use a broad and thin bat of charpie equably smeared with cerate. On this point every one should be free to do as he sees fit. The important point is to prevent the adhesion of the pieces of the dressing to the parts about the wound. Dry charpie in soft bats is then so disposed as to cover the sides and front of the stump. For this, two or three bats are enough; more would be rather hurtful than serviceable, from the heat which would be cherished by them. The oblong compresses necessarily vary in number or size according to the size of the stump. The middle of each should fall just upon the wound, and the ends reach without stretching to the root of the limb. That which is commonly laid across or around to fix the others a little above their point of crossing, is very seldom of any real use. A simple flexible bandage, rather narrow than too broad, finishes the dressing. After having carried this by circular turns from the end of the stump towards the root of the limb, the operator brings it back in the same way to the wound, in front of which M. Roux, among others, has a habit of crossing it several times, both for the purpose of imitating that kind of cap which was formerly so much employed, and to obtain an application of the bandage more regular and more neat, but augmenting the perpendicular compression at the expense of the circular. As this piece of prettiness may compromise the safety of the patient, it should be omitted at least whenever there is reason to apprehend a stagnation of fluids in the depths of the wound.

Instead of plasters, which make what is called in the schools, the *dry suture*, some operators employ the bloody suture, that is to say, they sew up the wound. This method, to which Pigray, Wiseman, F. de Hilden, Sharp, &c. had recourse in order to retain the skin, has been particularly eulogized of late years, by Hey, M. Benedict of Breslau, and by M. Delpech, who affirms that he has derived from it the greatest advantages; so that at Montpellier it is scarcely ever dispensed with after amputations. The interrupted suture is preferred in such cases, although the furrier's is equally convenient. For greater security, and to ease the threads, the operator may, as recommended by M. Delpech, place some small emplastic straps between them. If the employment of this kind of suture were not attended with great pain; if the reunion of the integuments formed the most important part of the operation; if the plasters did not effect the same purpose when properly applied; M. D.'s method would doubtless long since have been adopted; the contrary however being generally admitted to be the case, every thing seems to promise that in future adhesive straps will continue to supply its place. Seeing that after the cure by first intention, the cicatrix, although linear at first rarely fails to become puckered and to be surrounded with radiated wrinkles, just as after secondary union, M. Roux has sometimes determined upon pro-

ducing this wrinkling from the first by crossing the plasters in different directions, instead of placing them parallel with each other. But his first attempts having been unsuccessful, so skillful a surgeon has of course promptly given up this practice.

When the operator begins, like Louis, Alanson, and M. Richerand, by fixing a long bandage round the trunk, and brings it down by successive turns to the base of the wound, it is upon this bandage that the straps must have their hold; and differently from the other pieces of linen, this should be changed as seldom as possible. Kern, Klien, Walther, and the greater part of the German surgeons considering the wound which results from an amputation the same as any other recent and simple solution of continuity, use neither lint nor charpie, but just cover the stump with compresses kept continually wet with cold water. This practice has found many imitators in England and America, even among the surgeons in the hospitals, and I understand from M. Castello, physician to the king, and professor in the university of Madrid, that it has been for a long time followed throughout all Spain. In France it has as yet found but a small number of partizans. This is to be regretted, as, if I am not mistaken, the results obtained by foreigners have been most satisfactory. Disencumbered of a heap of useless dressings, the stump is kept much more cool; by preventing or moderating the inflammation to which it is subject, we place the contiguous surfaces in the best possible condition for immediate union, and the general reaction is reduced to a small matter. The experiments which I have made, show nevertheless, that cold water, although frequently useful, is not always without its inconveniences.

Appreciation of Immediate Union.—The ancient method of treating amputatory wounds is likely to produce a conical stump, necrosis of the bone, exhaustion of the patient by the continuance of suppuration, and the most lively pain after every dressing. Three, four, five, six, and even seven or eight months, are sometimes required for cicatrization, and when accomplished, it occurs in so thin and imperfect a form that it is torn by the least effort, and is always accompanied by a considerable deformity of the end of the stump. By the new method, say Alanson, Messrs. Guthrie, Klein, &c., the patient suffers incomparably less; the fever is always slight; no debilitating suppuration ensues; the stump remains firm, round, and well supported; and at the end of eight, ten, fifteen, twenty, or thirty days, the cicatrix becomes solid, and the patient is in a fit state to use an artificial limb. Out of ninety-two soldiers who were treated in this manner by Percy upon the field of battle, eighty-six were cured in twenty-six days; and out of seventy, Lucas lost only five. But while in France the chief of the military surgeons advocated with so much ardor the practice of immediate reunion, the individual at the head of the civil practitioners applied himself to its proscription. Out of six patients, Pelletan saved only one; in all these cases there were effusions of blood and *pus* between the lips of the wound, and over the passage of the vessels; and the only patient he cured, owed his recovery to an irruption of *pus* which burst the adhesion of the straps. "There is danger, then," says he, "in closing a wound from which blood must be poured out, which has an inclination to suppurate, whether on account of the ligatures which irritate it, or because the bone, more or less affected by the action of the saw, has necessarily a disposition to exfoliate." "The cure by first intention is more prompt," says M. Gouraud, who adopts the objections of Pelletan, "but it is more sure by immediate union: by prolonging itself, the suppuration prepares the patient for the changes which take place throughout the body after the loss of a considerable member; and whenever amputation is per-

formed for a disease of long standing, secondary union is the only method that can be properly adopted." It may be replied, that if the accidents mentioned by Pelletan frequently take place, such circumstances are rather the result of a want of necessary precaution, than the inevitable consequences of the operation. That there may be some danger in stopping suddenly a profuse suppuration of old standing, in closing in eight days a wound which results from the removal of a member which has for a long time performed the office of a secretory organ, is very true; but ought these exceptions, these feeble, and frequently questionable motives, to have weight against all the perils of mediate reunion?

In avoiding one extreme it is always necessary to guard against falling into the other. If the bleeding surfaces can be easily brought into apposition; if healthy parts only remain in the stump, immediate reunion has immense advantages, and ought certainly to be attempted. In contrary cases, the operator is permitted to conduct himself otherwise, to confine himself to bringing somewhat nearer together the lips of the wound after having placed between them balls or tents of lint, either bare, or with the interposition of a linen cloth pierced with holes. It would be imprudent, even dangerous, to persist in maintaining the contact, if in the course of three or four days the blood or other fluids have escaped in sufficient quantity to hinder the fair co-aptation of the parts from the bottom of the wound towards the edges. It is then proper to allow an issue, large and free, to the fluids which have accumulated behind the straps or the sutures, between the integuments or the divided muscles; to cleanse gently the whole extent of the sinous or fistulous passage, and afterwards to dress it with great care and tenderness, and to think only of union by the second intention. By proceeding thus the operator will obtain very frequently, if not always, a complete cicatrization in the space of fifteen, twenty, or thirty days, even after the amputation of the thigh, as I witnessed at *L'Hopital de Perfectionnement*, during the period of my service there with Messrs. Bougon and Roux.

C. *Combination of the two Methods.*—In order to reconcile the two preceding methods, it would be easy to contrive a third, by applying to circular amputation what is recommended by O'Halloran for the flap-operation. After having dressed the wound of the stump for eight or ten days without closing it, until it has become mundified and regularly covered with cellular granulations of a vermilion color, there is nothing to prevent bringing together the sides of the wound, and attempting to procure secondarily something like immediate union. I have practised this method a number of times with success, particularly at the *Hopital St. Antoine*, in the case of a patient whose thigh had been amputated by M. Beauchere; and again after amputations of the fingers, the metacarpal and *metatarsal* bones, and of the legs and arms. It has also been used with equal success by M. Roux, and has been extravagantly praised by Paroisse. All the ligatures having come away, the wound being cleansed, and the suppuration of a healthy character, it is generally easy to put the edges of the wound in contact, either at once or by degrees, and thus obtain co-aptation soon and without inconvenience. I am of opinion then, that with very few exceptions it is best to aim at immediate reunion; but if unpleasant symptoms occur which are justly ascribable to this mode of practice, the operator ought without hesitation to re-open the wound. I will add, that the results of this method are much more under the influence of art than those of secondary reunion, and that consequently they will be good or bad according to the ability or inability of the practitioner; according as he shall attach more or less importance to certain practical precautions which

cannot be learned from books, and of which only those who have used them can appreciate the importance.

§ 3.—*Consecutive Treatment.*

The patient having been returned to his bed, should be laid in the most easy position, a hoop should be placed to support the weight of the covering and to prevent it from bearing upon the stump, which reposes gently on a cushion or a folded cloth.

1st. *The Position of the Stump.*—This part is generally kept a little elevated, so that the muscles may be relaxed, which according to the opinions of some persons diminishes the determination of the fluids towards the wound. Some advantage is indeed derived from this posture in that respect, while there is no suppuration. But when this occurs, the posture in question favors the inflammation of the intermuscular cellular substance, the denudation of the bone, phlebitis, and the formation of abscesses; the wisest plan then, is to follow the advice of Hippocrates and of Alanson, and to place the stump in a horizontal position, or even inclining downward, as soon at least as suppuration is about to take place, and indeed in every instance where the form of the member will admit of this arrangement.

2d. *Immediate Medication.*—One or two spoonsful of wine may be useful in diminishing the torpor or faintness which commonly follows the operation. During the remainder of the day a gently antispasmodic anodyne is administered by spoonsful, with the infusion of linden, violet, wild poppy, or something of that kind, sweetened with any kind of syrup, as a ptisan. Except in cases where the patient is enfeebled by long suffering, the strictest diet is to be strictly enforced.

3d. *The Regimen* is, in other respects, the same as that enforced in acute diseases, or after all the greater operations. When the patient is robust or of a sanguine constitution, and the operation has been performed for a recent injury, if there has been no great effusion of blood, some, fearing a sudden plethora, have said much of the importance of diminishing the quantity of the fluids to prevent internal inflammations and the dangers of a general reaction. Many practitioners in Germany, England, and America, pursue, however, an opposite course. M. Koch, of Munich, administers to his patients from the very first day, coffee, wine, and even food. M. Benedict contends, that bleeding instead of preventing accidents is the means of favoring their occurrence. It is, says he, the strongest subjects, men whose bodies are full of blood, that most easily resist the operation of morbific causes, upon whom inflammations are healed with the greatest facility. Consequently, the more you bleed them the more you weaken them; the more exposed are they to disease; the inflammations which they contract become the more dangerous and the more difficult to treat. This severe diet, these abundant evacuations of blood prescribed by some operators, before and immediately after amputation, do not secure any real advantage except where intervening diseases, inflammatory symptoms manifest themselves upon the patient.

4th. *The First Dressing* should not take place in ordinary cases until about the expiration of three or four days, and sometimes even five or six, according to the opinions of C. Magati, Monro, and others, and the present practice in Spain. Patients in general have a great dread of it, and indeed it was formerly something for them to fear. No precaution was taken to prevent the adherence of the lint or of the compresses to the bottom or the edges of the wound; and as it took place one or two days after the

operation, and consequently before suppuration was established, it is no wonder that the recollection of it has been preserved, and that it is even more dreaded than amputation itself. On this point it must be said that patients have been agreeably disappointed. Pieces of linen or bandages being covered with cerate always render the separation of the other dressing more easy; at the expiration of three or four days the humidity and the natural sweating of the wound have on their part loosened the adhesions which might before have required force to effect a separation, so that the first dressing does not inflict more pain than those that follow. An assistant lays hold of the stump, which he clasps and gently holds in his two hands, always being careful not to give it the slightest jerk. The bandage, the compresses, being soaked with blood or other fluids, commonly harden together, in drying, so that it is very often more difficult to remove them. If then after having soaked them with lukewarm water, the operator does not succeed in their removal, it will be found necessary for that purpose to apply the scissors.

These first pieces being detached, the lint is freely moistened, and the outer layers only are removed while it yet adheres too firmly. As soon as it is exposed, the wound should be cleansed by gently dropping upon it lukewarm water, and afterwards dried with a piece of old fine linen or pledgets of lint, after which the dressings are reapplied as in the first instance, and are so removed and renewed from day to day.

If immediate union is aimed at, and no especial accident occurs, this first dressing is still further delayed. But in every instance, as it is in fact but seldom that complete agglutination takes place in every point, it is equally requisite to cleanse the stump on the third, fourth, or fifth day. If there is no suppuration to be discovered; if there is no threatening of the formation of sinus or fistulous passages; the lips of the incision should not be touched. The most that can be allowed, is to remove one of the straps, and to immediately replace it. In the contrary case, and when the plasters have become loose, they should be renewed one after the other, and by gentle pressure the purulent or other fluids should be assisted to escape. In order to detach these bandages, the operator draws them successively from their extremities in the direction of the summit of the stump, from whence they should be separated last, as there would be danger, in pulling them at one hold from one end to the other, of destroying the adhesions which is yet too weak to resist the slightest pull.

5th. The *Ligatures* seldom come away until the eighth or tenth day after having divided by ulceration the artery which they surrounded; it would consequently be useless to endeavor to withdraw them sooner; but when they remain longer, it may be of some advantage to draw upon them gently at every dressing. They are probably retained by some lamellar of fibrous substance included with the artery in the knot. The more immediately they encircle the artery, the sooner they will come away. There is every reason to suppose that their presence in the wound is useless after the second or third day, and that they might safely be removed after that period, if it could be done with ease. I have seen them yield on the third and on the fourth day, without any ill consequences, after amputation of the arm and of the leg. M. Beaufils of Nancy, who holds that after the sixth day it is best to hasten their separation, has contrived to subject them to a permanent tension to fulfill this indication, which MM. Kluge and Lau, have since endeavored to establish as an axiom.

§ 4. *Accidents.*

The accidents to which the amputation of the limbs may give rise, are serious and numerous; some may occur at the moment of the operation, others at a longer or shorter period after.

1st. *During the Operation—Hemorrhage.*—To patients in a weak state of health, the loss of blood during the operation may cause immediate and real danger; it sometimes takes place before the operator has time to tie up the vessels, either because the tourniquet has been relaxed or displaced, or because the assistant does not well apply compression, or because the operator experiences unusual difficulty in taking up the arteries. To prevent these inconveniences, it has been proposed to apply the ligature to the principal artery of the limb before commencing the incision of the soft parts. M. Blandin, reports an example of this practice, which is still followed at the hospital "Beaujon," by M. Marjolin. Mr. Guthrie and some others have thought to do better, in tying the arteries from time to time as they were cut. The art has no other resource in this kind of accident than compression, mediate or immediate, lateral or perpendicular, when the ligature cannot be applied. But there is still another species of hemorrhage which does not require the same kind of remedy; I mean that which comes from the veins, a kind of hemorrhage which is very abundant with some persons, and is even sometimes very troublesome. It is caused by the provisional compression preventing the blood from returning in the direction of the trunk, or else to some defect in the respiration. In order to stop the effusion, some persons advise to tie the principal vein; Monro, Bloomfield, Hey, and Guthrie, are of this opinion. Amongst ourselves the practice is generally different. We remove at once every thing which may impede the course of the blood towards the heart. We induce the patient to make long inspirations, and the hemorrhage is almost instantly arrested.

The *syncopes* which result from hemorrhage, pain, or the state of excitement into which the operation sometimes throws the patient, require little more than moral means. A spoonful of wine, when the symptoms are foreseen, cold water, vinegar, or cologne water sprinkled on the face, or applied to the nose, and all the other remedies generally used in such cases, do not require more particular mention here. It is not unfrequently the case, that immediately after the separation of the limb the stump is seized with a tremor which it is very difficult to allay, or with a species of convulsive or spasmodic movement which requires the greatest attention. At such a moment we should attract as forcibly as possible the attention of the patient, and rouse his courage; we intreat him to hold for himself the root of his limb, unless it should be thought better that an assistant should clasp it firmly with both hands until the dressing is completed: this state generally remains but a few minutes; if it seems, however, disposed to continue longer, the stump when placed upon the bed should be fixed by a cloth or napkin folded in the manner of a cravat. This is a juncture at which opiates are particularly indicated.

2d. *After the Operation*, the accident to which the patient is most liable is that of *hemorrhage*, which happens either because some important arteries have been left untied, or because one or more of the ligatures have become relaxed, but more frequently than is often believed from a species of imitative exhalation proceeding from the surfaces of the wound. After the third or fourth day, hemorrhage rarely occurs but in this way, unless the ligatures

should have cut some of the arteries by ulceration : after the eighth or tenth day it is difficult to account for it. Bromfield, Guthrie, and other practitioners, have seen it appear after a delay of three weeks, a month, or even a longer period. There is reported an observation of a patient operated upon by M. Roux, in whose case hemorrhage did not appear until after the expiration of *two months*. The inflammation of which the vascular tunics become the seat, in the thickness of the stump, the suppuration which surrounds them at the bottom of fistulous passages, can alone account for this species of perforation. Hey and Hennen contend that consecutive hemorrhage is frequently caused by the skin retracting and compressing circularly the subjacent tissues, particularly the venous canals, and that it is by the vessels of this latter class that the blood is permitted to escape. This opinion seems to me any thing but well founded. When the blood escapes through the medium of the veins (according to Ponteau), it is to be attributed to the unequal or too forcible compression exerted by the bandage upon the stump, rather than to the contraction of the skin. It is then sufficient to remove the dressings and to re-apply them more methodically, in order to immediately remedy the accident. Another species of hemorrhage which appears to have been first eradicated by M. Gouraud, is that which comes from the bones in case of necrosis ; the blood is perceived at each dressing to arise between the living and the dead tissue ; compression or obstruction will not arrest its progress, nothing in fact but the removal of the affected organ. Congestion, or a slight inflammation of the stump, are causes of hemorrhage which may be checked in different ways. 1st. By frequently soaking all the dressings anew with cold water. 2d. By applying the tourniquet or the garot to the principal artery of the part. After having found these means insufficient, it is then proper to remove the dressings, in order to seek for and to tie the vessel which gives rise to the effusion. As it is but seldom that after the first twenty-four hours this last method of treatment succeeds, in consequence of the changes which have taken place over the whole extent of the bleeding surface, there is then nothing to be done except to apply agaric or sponge upon the point from whence the blood exudes, as advised by White and Brossard, or to stuff the wound in any way whatever until the hemorrhage is arrested; to use the machine invented by Petit; to compress the open vessels immediately by means of pellets of lint or of linen sprinkled over with colophony;by the fingers of the assistants, which are successively relieved for the space of some days, or what is much better when it can be done, to discover the principal artery and to tie it above the wound, as Messrs. Roux, Dupuytren, Delpech, Somme, Ghidella, and Arnel have done with success. Yet in a case cited by Blandin, and some others mentioned by Mr. Guthrie, this ligature, after the manner of Anel, has failed in stopping the effusion of the blood, and the patient has finally succumbed. If the open vessel should be surrounded by soft parts, the operator may cut round its circumference with a single sweep of the point of a bistoury at the bottom of the wound, and close it immediately by placing a thread in the circle of the incision, as M. Sanson has once done with success.

It would be wrong to count as a hemorrhage that sweating which rarely fails to soak through, or to affect in some degree the dressings, the linen, and even sometimes the whole thickness of the cushions, after the first or second day. Even when it is pure blood and not a sanguineo-serous effusion, there is no occasion for alarm unless the patient have experienced from it some degree of weakness. As a general rule, while the pulse keeps its force, and the paleness of the countenance is not increased, cold ablutions and the tour-

niquet will suffice, if it should be thought proper to make any application whatever.

Conical figure of the Stump.—This, which was formerly the almost inevitable result of amputation, has, since the works of J. L. Petit and of Louis, become extremely rare. By immediate union, it is almost always prevented. It is now only after cure by suppuration that it sometimes occurs. As it is owing entirely to the retraction of the muscles, it depends upon the operator to avoid it, unless the healing of the wound have been retarded by some unforeseen obstacle. The processes of Petit, Brunninghausen and others, which consist in bringing only the skin over the surface of the stump, are considered as less efficacious than those of Louis, of Alanson, Desault, and of Dupuytren, or all those in fine, which consist in cutting upon the bone the adherent muscles farther up than those which are loose; but this is a question to be hereafter considered.

Upon this subject it must not be forgotten that the muscles retract much more upon some subjects than upon others, in proportion as they may be formed of longer fibres; may have been divided farther from their point of origin; may have been more irritated, be slower in reuniting, or in incorporating themselves with the cicatrix; and we should not confound their primitive with their secondary retraction.

The contraction which immediately follows their division is not the only one which is observed. The muscles are frequently seen, and particularly upon persons of much strength or fullness of make at the time of operating, but who have become enfeebled soon after—they are frequently seen, as I have said, to retire deeply into the sheaths, to abandon the bones which they have previously entirely covered, and to give a conical form to the stump which had presented a deep hollow at the time of the first dressing. So that the first division should be made so much farther from the last as the limb is larger, and the amputation too should be performed further from its root in the same proportion.

After the operation, the retraction should be opposed by applying to the stump the moderately compressive bandage of the ancients, as improved by Alanson, Louis, Richerand, and others; taking care that instead of having a tendency to force the flesh backwards, every part of the dressings shall, on the contrary, operate so as to bring it forwards. The wound should be dressed as gently as possible, avoiding every thing which might irritate, favor suppuration, or delay the union; and the part should be placed in a state between flexion and extension, so that all the muscles may be somewhat relaxed.

From whatever cause it may arise, the projection of the bone is always an unfortunate circumstance; when it is but slight, and not accompanied by denudation, according to the practice of M. Gouraud it should not be touched. Nature will perfect her own work, and will finally displace the cicatrix, so as to bring the skin over the end of the stump.

Exfoliation, which was long considered an inevitable consequence of amputation, is now counted an unfortunate accident. As it is extremely slow in its progress, requiring thirty, forty, or perhaps sixty days to complete its work, it should seldom be left to the unassisted efforts of nature. The hot iron or potential cautery, the nitrate of mercury, for instance, which were until of late frequently employed, and that even by Sabatier, have scarcely any effect in hastening the process.

It is much better to remain contented with slight efforts with the forceps, repeated at every dressing, upon the osseous eschar, as soon as it becomes movable. It is well to remark, moreover, that the eschar will frequently

disappear without any apparent exfoliation. An adult, whose leg had been amputated by M. Beauchene, was affected by necrosis of the angle of the tibia, of which we satisfied ourselves by means of the probe. The wound closed over it, but a small abscess betrayed itself about a month afterwards; I opened it and a fluid and reddish pus issued forth, but the necrosis no longer existed, and the fistula soon finally healed. In another case where the whole stump had suppurated, I saw for a long time the extremities of the tibia and fibula of a lime-like whiteness, slightly tinged with yellow, jagged, sonorous, and, in short, completely dead. By degrees they were lost in the thickness of the flesh, the cicatrization was affected, and in the space of four months the cure was complete.

Removal of the dead bone, which was the subject of so much debate in the ancient academy, is given by Sabatier as a simple and easy operation without pain; by others, as a second amputation, often more dangerous than the first. When this operation is resorted to, it must be performed high enough to avoid the necessity of its repetition; high enough to secure the patient against a recurrence of the projection. It is easy to see, that if the integuments and the superficial muscles are to be much removed from the end of the bone, the operation must be extremely painful, whilst, if nothing is to be done but to saw off the superfluous part at a few lines above the necrosis, the operation will be one of trifling importance.

Inflammation sometimes, and particularly after immediate union, seizes upon the periosteum, which suppurates and peels off. The bone thus denuded, seldom fails to mortify through either the whole or a part of its thickness. At other times, the necrosis begins in the tissue of the organ itself, and the danger of the accident is then increased. The first duty, in such a case, is to open with the bistoury a free passage for the escape of the pus, or other morbid fluids, and endeavor to restrain the extension of the disease by applying an expulsive compression from the root of the stump down to the wound. Then we must wait the exfoliation, or else when the disease has ceased to extend, the dead bone is cut off, or amputation is again performed at a higher point, as in the remedy for conicity.

3d. *The Hospital Putrefaction*, which often follows amputation, is one of the most unfortunate complications which can possibly occur. When it attacks the stump and invades to a considerable extent the muscles of the integuments, when the bone is denuded, and when topical applications and among them caustics have been essayed in vain, then amputation above the next articulation, or if that is not practicable, simply above the limits of the affected part, is our last resource. M. Gouraud has obtained many unexpected cures in the army, and in the Hospital of Tours, where I have myself witnessed them. Messrs. Percy, Willaume, and Desruelles, have also followed the practice, and I do not hesitate to recommend it in the cases which I have defined.

4th. *The Inflammatory Swelling of the Stump* sometimes presents itself under the form of a simple erysipelas, and sometimes with the characters of erysipelatous phlegmon. In the first case if the skin alone is affected, the emplastic straps are often the cause, either on account of their being too tight, or because they contain too great a proportion of irritating matters. It is enough, then to remove them, and to envelope the inflamed surface for some days with emollient cataplasms. In the second case the accident becomes more serious, and requires more particular attention. The inflammation is quickly carried to a great extent; the skin and the muscles are soon dissected by pus; the subcutaneous tissue, the deepest cellular interstices sometimes mortify and come

away in sloughs, an ataxic or adynamic fever arises, and puts the patient in the greatest danger. Secondary reunion is seldom attended with similar accidents. This is, therefore, one of the best founded objections which can be adduced against primitive coaptation.

From their first onset, these symptoms should be combated with energy. They are sometimes calmed by laying the entire surface of the wound bare so as to dress it flat, or by covering the stump with leeches, and afterwards with cataplasms; but when such means fail of success, or it is too late to make the application, the most efficacious remedy which is known to me is that of deep and multiplied incisions. In 1828, at the close of summer, I had occasion to try the flap method in amputating the leg; the whole thickness of the stump soon became the seat of inflammation; erysipelas and purulent collections already occupied the inferior third of the thigh; stupor and other adynamic symptoms advanced with frightful rapidity. I thought the patient lost, beyond all hope. M. Beauchene, who thought differently, made eight or ten incisions in the different inflamed parts of the skin. The symptoms from that time began to retrograde, and the patient recovered, much to my astonishment I must confess. Against that erysipelas of a greyish tint which so often terminates in gangrene after amputation, M. Larrey employs the actual cautery. The hot iron being applied with some force in such a form as to imitate the branches of the fern or the nerves of a laurel leaf, for example, or any other figure, upon the inflamed points, produces sometimes most wonderful effects, the extraordinary results of which I have myself witnessed at the "*Hopital de la garde.*"

If the disease has become local after having given rise to numerous general symptoms, there sometimes results a denudation of the bone or fistulous passages, a pointed stump, which can only be remedied by a second amputation. "Experience has taught me," says Gouraud, "that the patient endures the amputation of the stump better than that of the limb, and that the first has a greater chance of success than the second; out of ten individuals upon whom I operated in this way in 1814 and 1815, nine were cured." Instead of affecting the whole stump, the inflammation confines itself in some cases to the cellular tissue about the vessels, and particularly about the subcutaneous veins; it then soon forms for itself in the course of these vessels small purulent spots or abscesses which should be opened at an early period, if antiphlogistics or compression have proved unable to prevent them.

5th. *Phlebitis.*—The veins often become inflamed, either separately or with the surrounding parts. Here, as in every other case, phlebitis is extremely dangerous. Hunter, Abernethy, Travers, and others, proved it long since. The symptoms of adynamia, putridity, and of ataxia, to which it very soon gives rise, are almost always followed by death, so that it is one of the most formidable accidents which can possibly occur after amputation. The dangers with which it is accompanied, attributed until quite lately to the propagation of the inflammation from the stump towards the heart, in fact depend entirely upon another cause. The mixture of pus with the blood, and its transportation through all the organs, present a much more satisfactory explanation, as I believe I was the first formally to express in 1824, 1825, 1826, and particularly in 1827; and as has been since proved by Messrs. Marechal, Reynaud of Marseilles, Dance, Legallois, Arnott, Blandin, and others; an explanation of which several of the ancients had some vague notion. Purulent resorption is another accident of which the dangerous results are exactly similiar.* The recent researches begun by M. Monod,

* See introduction.

and continued by M. Reynaud and others, go to prove that the inflammation of the medullary tissue of the bones, of their proper veins, and of their spongy substance, participate also in the production of the symptoms generally attributed to phlebitis or the resorption of pus; but this question demands further investigation, and if decided in the affirmative, would make entirely for amputations in the articulation, by exposing more fully the dangers of amputation in the body of the limbs.

6th. *Cystitis.*—"It is often necessary," says M. Gouraud, "to use the sound upon the subjects of amputation," and many observers have made the same remark. Whatever may be the primitive cause, cystitis is no very rare occurrence after amputation, particularly of the abdominal extremities. It should be apprehended at the least symptom of any affection about the urinary passages. I need not say that vesications should be proscribed when this affection is threatened; but M. Blandin is certainly mistaken in connecting it with the use of this therapeutic agent, for it is observed when no preparation of cantharides has been used, as I have myself seen in the case of a female, upon whom amputation of the thigh had been performed by M. Roux, in 1826. For more ample details upon the accidents which have been here passed in review, upon tetanus, and every other disease which may complicate the results of amputation, I can only refer to the treatises on pathology, properly so called.

Changes which take place in the Organic State of the Subjects of Amputation. After the removal of a limb, changes sometimes of a very remarkable nature occur in the person of the subject known to all surgeons, and of late well described by Messrs. Gouraud, Cloquet, and others. Some affect the stump, others the constitution in general.

1st. *In the Stump.*—The muscles, the cellular tissue, the aponeurosis, the tendons, the bones themselves, undergo at the place of section a transformation of such a character, that all the parts are confounded in attaching themselves to the cicatrix, and constitute there nothing but lamallæ or fibrous cords, more or less dense, and more or less distinct. Afterwards the stump, which had at first become meagre, becomes the seat of a more vigorous nutritive action, increases in size, and at a longer or shorter period puts itself in this respect upon a level with the root of the other limb.

2d. *In the rest of the Economy.*—The subjects of amputation attain a remarkable *embonpoint*, acquire an increase of energy in the organs of digestion, of circulation, and of reproduction; the fluids of life being obliged to move in a more contracted circle, increase the activity of all the functions. They tend to induce the characteristics of the sanguine temperament. The sanative efforts of nature to remedy the plethora of the economy, manifest themselves according to age or sex, by epistaxis, hemorrhoides, more abundant menstruation, frequent stools, transpiration, and more copious secretions. Garengeot advises, that in order to prevent plethora and a revulsion of blood, bleeding should be practised from time to time upon those who have been subjects of amputation; that at least one-fourth part of their customary nourishment should be taken off during the first year, and the subject should abstain from all violent exercises. A soldier of the army of the eastern Pyrenees had both thighs amputated, and recovered. The activity of all the viscera, and especially of the stomach, increased in a singular degree; in a short time this man became extremely fleshy, the consequences of which it was difficult to calculate. The dejections became more frequent without any perturbation of the bowels, but the immobility to which this double mutilation subjected him, produced a diseased plethora. A species of carriage

was procured for him, but this passive movement did more harm than good, for it favored the digestion more than transpiration or the other excretions. This unfortunate man finally sunk under the burden of sanguineous plethora. "I have made these observations by hundreds," says Mr. Gouraud, "and they certainly appeared to me to be worthy of the attention of the faculty." I have myself seen two very marked instances of a similar character.

Art. 2.—The Flap Operation.

History.—Amputation by flaps seems to be ascribed by Sprengel and Gagnier, to Celsus, Maggi, and others of the older surgeons, such as Pare and Hilden, and was not, as is generally believed, proposed for the first time by Lowdham in his letter addressed to Young, and published in 1679. We shall see presently that Leonides and Heliodorus have clearly described it. It consists in cutting out of the soft parts one or more flaps, which permit the wound to be immediately and completely closed. After Lowdham, this method was extravagantly praised, and differently modified by Verduin, of Amsterdam, in 1669; by Sabourin, of Geneva, in 1702; by Morand, De la Faye, Garengeot, before the middle of the last century. It was opposed by Koenerding, a countryman of Verduin, by Heister, and many others, but was soon defended by P. Massuet, Le Dran, Ravaton, Vermale, Quesnay, and others. Since then O'Halloran, Messrs. Dupuytren, Roux, Guthrie, Klein, Kern, Langenbeck, Larrey, Lisfranc, and a multitude of other surgeons, have had recourse to it; so that its history presents really two distinct epochs, the one comprehending all that was said of it during the last century, and the other belonging particularly to the present time.

Appreciation.—Lowdham holds that this method is more prompt, less dangerous, that it occasions less risk of tetanus or hemorrhage than circular amputation, that it renders the ligature of the vessels useless, prevents exfoliation, obtains a speedy cure, and makes very easy the application of an artificial limb. Of these advantages there are several which have not been confirmed by experience. In the first place it cannot be perceived how it can be less painful than the circular method, or can more surely prevent tetanus. The exfoliation of the bone is a very rare thing; instead of being frequent, as it was then thought, and as the preventive means are not to be applied to the stump itself, it is, in this respect, a matter of indifference whether the amputation has been performed by one method or the other. Finally, it is easy to see that it does not dispense with the ligature of the vessels, and that the incision scarcely ever cicatrizes without suppurating for a longer or shorter period. Immediate reunion is an incontestable advantage; and if the improvements in the circular method did not permit the attainment of the same end in the majority of cases, there is no doubt that amputation by flaps would, at this day be generally preferred. It must also be confessed, that it makes it easy to avoid the protrusion of the bone, the pointed shape of the stump, and that it preserves enough of the soft parts to close without dragging the widest and deepest wounds.

Manual.—The flap operation is performed in two general ways, from without inwards or from within outwards. In the one, the incision is carried from the skin towards the bones, whilst in the other the operator commences by plunging the knife through the member so as to cut the flap from its root towards its free border. If the first method is more regular and more sure, the second is much more rapid and more brilliant. In operating in the first of these modes, it is well to begin by dividing the integuments at the first stroke, and

causing these to be drawn back by an assistant, to effect at a second stroke the division of the muscles a little higher up. By this mode it is easy to give to the flaps the desired form and dimensions; but the operation is divided into stages, and thus made less rapid.

In piercing at first the thickness of the limb, the point of the instrument is liable to contact with the bone, and often attacks organs which it might be best to preserve, divides irregularly some tissues which it is important to cut smoothly, and does not always cut the flaps as thick as is necessary for the attainment of the end proposed. This mode of operating has in our days found numerous partisans and able defenders, but it is hardly ever adopted any more than the preceding, except in amputations at the joints. On the whole, it appears to me that too much value has been accorded to the flap method. The wound which results necessarily presents a more extended surface than if it had been circular. The muscles which the operator is so careful to preserve, expose him to several inconveniences. If inflammation seizes them, they suppurate very profusely, imbibe the fluids like a sponge, and favor, in a very high degree, purulent resorption and phlebitis. And again, they seldom attach themselves over the extremity of the stump in the centre of the cicatrix. After all, it is always the skin that corresponds with the osseous protrusions which the semilunar form of the flaps, by the retraction of the angles of the wound, favors more than any other method. For the rest, it offers a certain number of distinct varieties. Lowdham, Verduin, Sabourin, Guthrie, and Græfe, content themselves with a single flap, which they apply against the bleeding surface. Vermale advises to make a flap on each side, and to form them by thrusting the point of the knife upon the part of the bone where the saw is to be applied. In order to avoid deception with regard to their length, he advises before commencing to mark with a red thread the points of departure and of termination. Ravaton and Bell divide the skin and the whole thickness of the muscles circularly, at the first stroke of the knife; another incision, which falls upon the bone parallel to its axis behind and before, serves then to separate two flaps, which are immediately dissected and drawn up. The procedure of Vermale is now almost the only one which is followed, even for the formation of a single flap. The practice of Ravaton should by no means be imitated. The circular division first made is completely wasted. The flaps thus squarely cut are too thick towards the end, and retard considerably the direct reunion.

Two flaps should always be preferred whenever it is possible to give them a size and thickness nearly equal; but if this cannot be effected, it is much better to have but one. In this latter case it is required that the flaps, in order to close the wound, should be of considerable length, that it should be bent nearly at a right angle, that it should be subjected to a pressure, and to tractions which should be very likely to compromise the success of the operation.

We shall see, in describing amputations in particular, the cases in which this method of operating is inapplicable.

Art. 2.—The Oval Method.

This method is less ancient than the two preceding. It was described at the commencement of the present century by M. Chasley, Messrs. Langenbeck, Beclard, Guthrie, and Richerand, as applicable to certain particular amputations, but it was not really generalized until the year 1827, by M. Scoutetten. According to his opinion, its principal advantage is that of

always permitting the incision to be made from without inwards, from the superficial towards the deeper parts, as in the circular method, and of preserving enough of the flesh to bring the lips of the wound together as easily as in the flap method; so that, says he, it places itself between these two, and is, so to speak, a link between them. It is certain, that by the oval method a neat and regular division is obtained, and that most frequently enough of the tissues may be preserved to justify an attempt at direct reunion, and that there are but few points of the members to which it is not applicable.

Its distinct character is to present an incision of an ovoid form, already recommended by Lassus, in 1793; by M. Chasley, in 1803 and 1804; by M. Langenbeck, in 1809; and from which Mr. Scoutetten derived the title which I have preserved for it. It is performed in two ways, scarcely distinguishable the one from the other. In the first and the oldest mode, the operator begins by describing a triangular flap in the form of a V inverted, a little below the passage where it is necessary to apply the saw, or to disarticulate the bone. After having turned down the apex of this triangle, and raised the two lips of the incision, he passes, by penetrating the joint either from above to below or from one side to the other, behind the bone, grazing its lower surface, and finishes by reuniting the two previous incisions at the base of V, where the vessels had been preserved. M. Scoutetten prefers giving his incision from the first a form completely *oval*, being careful, in passing under the vascular and nervous lash or upon the part which is to form the greater extremity of the oval, to divide only the integuments. This is no otherwise important than as giving a little more regularity to the incision.

Some persons have advised a combination of these methods in certain cases, for the purpose of profiting by the advantage of the one, and of avoiding the inconveniences of the others. It is thus that O'Halloran adopts the following modification, which in his opinion should command every suffrage in favor of the method of Lowdham. Instead of applying compression to suppress hemorrhage, he advises, as also does Garengeot, to tie the arteries carefully, and, to be more certain that no serious accidents may happen on the part of the stump, he advises to dress the wound flat, and let it suppurate for eight or twelve days, then to raise it as soon as it is covered with cellular granulations, and adapt it carefully to the rest of the wound. White and M. Paroisse declare that they have tested this modification in practice a great number of times with the most favorable results, and I have come to the conclusion, from the experiments which I made of it under the head of secondary direct unions, that it has been but badly appreciated amongst us, and that in a multitude of cases it holds out the most undeniable advantages. What O'Halloran has added to the procedure of Lowdham, Beclard has advised for that of Vermale—when the flaps are formed of tendinous parts, of fibrous sheaths, and of synovial sacs. After having cut the skin circularly, instead of incising the other soft parts in the same manner, M. J. Cloquet has thought that in certain cases it would be better to pass the knife between them and the bones, and to cut outwards as in the flap method. M. Dupuytren has applied the same modification to the flap operation.

B.—*Amputations in Contiguity.*

History.—The perusal of the works of Hippocrates teaches that amputation at the joint was often practised by the ancients. Galen and Heliodorus speak of it in the most explicit terms. Even the Arabs were not ignorant of it.

Sprengel is evidently mistaken, when he asserts that it had not been mentioned from the time of the Grecian writers up to that of Munnicks. Guy de Chauliac formally avers, that "if corruption reaches to near the joint, the member should be cut off in the joint itself with a razor or other instrument, without using the saw." Pare has not passed it by in silence. F. de Hilden treats of it as a common method, and Pigray expresses himself thus on the same subject: "Some persons make a difficulty of cutting into the joint or near it, on account of the nervous parts, but the danger is not so great. I have seen many cases of it which turned out well." The efforts of Le Dran, of Morand, of Heister, of Brasdor, and of Hoin, have only brought it again into vogue, by doing away the prejudices with which it had been surrounded by the physiology of the middle ages. It is practised, like amputation in the continuity, by the three principal methods, but most commonly by the flap method and by the oval. We shall see, however, that the circular method is quite applicable to it, and that it is even preferable in a good number of cases.

Appreciation.—The advantages of disarticulation are, that it is more prompt and more easy of execution than the preceding, that it does not require the division of the bones, facilitates an immediate reunion, and admits of the preservation of a greater length to the limb. It is attended, however, with the inconvenience of laying bare large osseous, or cartilaginous surfaces, at least in most cases; requiring the use of instruments on the thickest points of the skeleton, and those which are least abundantly furnished with soft parts; compelling us frequently to make use of tendinous or synovial tissues to close the wound; of presenting a solution of continuity perhaps, a little less regular; but it is not true, as it was long thought, that, all other things being equal, it exposes more than amputation in continuity, to nervous affections, to tetanus, to abscesses, to purulent fistulæ, and to the symptoms of general reaction, although these phenomena may sometimes have occurred after it. It is executed with an inconsiderable number of instruments, and does not require such complicated dressings as the other method. A knife, or the simple bistoury is almost always sufficient for every step of the operation; the conicity of the stump, the projection of the bones, the retraction of the muscles, are the less to be feared, as the soft parts are scarcely displaced, the adhesion of the flaps is easily obtained, and inflammation does not develop itself to a greater degree than is necessary to determine a direct union.

As the division passes through only the skin, the cellular or fibrous tissues, and some of the muscular attachments, inflammation, abscess, or general reaction are generally less to be feared; although large in appearance, the wound is in reality but small in extent, because the cartilaginous crusts which form the bottom being insensible and inert, perform no part in the process of inflammation or of suppuration.

The fears entertained by the surgeons of the last century, of wounding the diathrodial cartilages, of exposing them to the air, or of touching them with the instrument, are at the present day exploded. Instead of so many precautions heretofore recommended in order to avoid the articular surface which rests at the bottom of the wound, many of the moderns have even gone so far as to recommend wounding it on purpose. M. Gensoul, for example, is of opinion with Richter, that by cutting it off with the point of the knife you multiply the chances of cicatrization in the first intention. This practice, which is also adopted by some of the Parisian surgeons, and which is accompanied with no inconvenience, yet appears to rest upon a reason the importance of which is by no means proved. In fact, it is inaccurate to say,

with Beclard and many others, that after amputation in contiguity, the smooth front of the cartilage does not unite itself with the flap, that it remains free even after a final cure, unless inflammation have been by some means or the other, excited in it. Whether the instrument has touched it or not, it contracts nevertheless, and that very quickly, firm adhesions with the tissues which cover it. If the agglutination is not immediate, the cartilage is sometimes pushed forward by cellular granulations which arise from the bone behind it, and detaches itself in small parcels, sometimes in large flakes, sometimes in the form of a shell, and exposes a vermilion wound, which cicatrizes easily. In a contrary case it does not at first sensibly change its aspect; it only loses its polish, and becomes rugous; but a molecular action is sure to develop itself, to sap it insensibly, and to cause its entire disappearance. It is a true epidermis of the bone, a simple "anhiste" stratum, and cannot retain its distinctive characters longer than the articular movements are kept up. As soon as any of the living tissues rest upon it, the vitality of the bones expel or destroy it in creating the cellulo-fibrous stratum which forms the basis of every perfect cicatrix. In which ever way the operation is performed, the tendons, aponeurosis, nerves, and vessels, at last fix themselves firmly upon the extremity of the stump, so that the patient can move it with as much ease as before the operation.

When the articulation is surrounded by a large capsule, it is well to remove it as completely as possible with the bone, without, however, in any case disturbing that portion which remains. Instead of the tendons being left to hang outside of the incision they should on the contrary be cut as deeply as possible, in order that their presence may not impede the direct reunion. The incision of the fibrous or synovial sheaths, advised by Garengeot and Bertrandi, with a view to prevent inflammation or to oppose the formation of purulent fistulæ, is entirely useless, and should not be practised without particular indication.

The fistulæ which sometimes follow in the train of amputations at the joints, are formed either because some point of the cartilaginous surface which has not exfoliated nor united with the flap of soft parts, continues to exhale synovia; or perhaps because one or several of the tendinous sheaths or bursæ which have not closed, furnish fluids of a similar kind. Compression, irritating injections, caustics, &c. easily heal them, and they are seldom followed by any unpleasant symptom. For the rest, amputations in continuity are not always free from accidents of the same kind. On the whole then, the extirpation of limbs is not more dangerous than amputation properly so called.

CHAPTER II.

AMPUTATIONS IN PARTICULAR.

SECTION I.

Thoracic Extremity.—The superior extremities, which are so much exposed by constant use and their relations to external agents, to contract all kinds of lesion, frequently require amputation. It should here be held as a general

principle, that as little should be removed as possible. The smallest portion which can be preserved rarely fails to be useful. Thus we amputate separately, the fingers, the different bones of the metacarpus, the hand itself, the wrist, the fore-arm in its continuity and at its articulation, the arm at the different points of its length and at its union with the shoulder, and the shoulder itself.

Art. 1.—*Fingers.*

The amputation of the fingers, an operation scarcely recognized by the ancients, is now performed frequently and in many different ways, whether the operation is confined to the removal of one of their phalanges, or whether they are removed entirely, whether amputation is performed in the continuity of the bones which compose them, or whether you prefer to disarticulate them.

Anatomical Remarks.—The fingers have for the basis of their structure three osseous pieces, which are articulated by ginglymas for the two anterior phalanges, and by enarthrosis for the metacarpal phalanx. They further consist of tendons, fibrous sheaths, synovial sacs, arteries, voluminous nerves, and a cutaneous stratum remarkable in the appearance of its anterior portion. On their palmar face are found the two flexor tendons and the fibro-synovial canal in which they glide. The one is attached to the articular tuber of the last phalanx, and by a fibrous cord to the metacarpal phalanx. The two strands of the second attach themselves to the sides of the middle phalanx. As all these tendons meet in the hollow of the hand in order to reach the wrist or the fore-arm, there can be nothing more dangerous than the inflammation of their sheaths after the amputation of the fingers. The cellular tissue, gathered to the front in the form of a cushion, directs to this quarter in the search of soft parts to cover the stump after the operation. Their dorsal face being more round renders it impossible to cut upon it a flap of proper size or thickness. The two arteries which run along their sides lie too near to the bone to let compression be substituted for the ligature. The two phalangeal articulations present this circumstance worthy of remark, that being held by two very strong lateral ligaments, and in the rear by firm tendons, they cannot be passed through without certain precautions. The pulley in which they terminate, and the small cavities, separated by a ridge which may be found upon the posterior extremity of these two phalanges, is also important to be noticed, if we desire to give a sure direction to the action of the bistoury.

The skin presents data so much the more important as its pathologic state does not ordinarily deprive us of them. Amongst the number of folds and wrinkles with which it is furnished on the dorsal side of the articulation, there are three which should be particularly noted. The one which is perfectly transversal corresponds always with the inter-articular line; the second, convex towards the hand, lies over the point of union of the head of the posterior phalanx with its body; the third, convex towards the end of the finger, guides to the corresponding point of the anterior phalanx. The palmar side of the distral phalangeal articulation is immediately beneath, or at the most at one line in front of the only crease which the skin presents in this place. It is the same with the middle articulation, in relation to the deepest line of the teguments by which it is surrounded.

The metacarpo-phalangeal articulation, which is surrounded in the same manner as the preceding by two lateral ligaments, and the flexor and extensor tendons, has besides, before or on its sides the terminations of the lumbricales and interosseous mucles, and the trunk of the collateral arteries, which

divides a little farther on. As this phalanx turns upon the head of the metacarpal bone, the latter is, during flexion, almost entirely concealed beneath the former, which forms of itself the projection which is then remarked upon the fist. These articulations are not all on the same line; the transverse mark in the palm of the hand, which corresponds to the articulation of the fore and little fingers, is found several lines behind that of the middle fingers. The best means of discovering these joints, is to seek for them at about ten or twelve lines from each interdigital commissure. From this disposition it arises, that the small cushion of their anterior face may easily serve to form a flap capable of completely covering the metacarpal bones after the removal of all the fingers.

§ 1. *Partial Amputation.*

Formerly the fingers were always amputated in the continuity of their phalanges, and by proceedings more worthy of a butcher than of a surgeon. Even from the time of F. de Hilden, the operation was performed with cutting nippers, a gouge, scissors, or some other instrument of a similar description, accompanied by a blow with a mallet or small leaden hammer: more recently, it was thought that a great step had been taken towards perfection, by the substitution of a small saw in the place of the former instruments, which had, according to Hilden, besides their coarseness, the inconvenience of breaking the bones, and of giving rise generally to the most serious consequences. Verdue, Petit, Garengeot, Sharp, and all the moderns, have opposed this manner of operating, so that for a long time the amputation of the fingers in the continuity has been discarded. It is said that the operation is much more difficult, and that the portion of phalanx which it preserves cannot be of any use. On this point it appears to me that they have gone too far; and that in accordance with the ideas of Le Dran, Guthrie, and S. Cooper, it would be much better when it can be done to saw the phalanx than to extirpate it entirely, for there is no part of any of the fingers which has not its use and its importance.

1st. *Manual.*—A. *In the Continuity.*—Supposing that the disease is confined to either of the two farther articulations, it is evident that it cannot be entirely removed except by cutting the posterior phalange to a certain distance from the affected joint, and that the remainder of the bone will not be without its value to the patient. This slight operation may be performed by the circular or flap method.

Circular Method.—In the first case the operator incises the integuments as near as possible to the diseased part. He then forces them back in order to divide the tendons, and to make section of the bone with a little saw, at about three or four lines higher than the point of beginning.

Flap Method.—In the second case the operator may content himself with a single flap, which should be cut in front, or he may, as was already done by Heliodorus, make two, each somewhat shorter than if it were alone, when the state of the soft parts does not forbid. Immediate union should always be attempted.

B. In the Contiguity.—Circular Method.—The operator here incises the skin at about three lines in advance of the joint. The assistant draws it back to permit him to divide higher up the extensor tendon, and to enter between the phalanges from the dorsal side, after having divided the lateral ligaments. In coming out through the joint to the palmar side, the bistoury, by a continuous movement, divides the flexor tendons. This method is very ancient, was

pointed out by Garengeot, recommended by Sharp, Bertrandi, Leblanc, Lassus, and others, and generally adopted in England; is as good as any other, and easily admits of immediate union.

Flap Method.—a. Process of Garengeot.—Flaps of the same length, one Dorsal, the other Palmar.—Garengeot recommends the method of Ravaton, or rather that of Heliodorus, that is, to make two lateral incisions, united distrally by a circular one, to dissect and raise the two flaps thus formed up to the articulation, before passing through it, and then immediately to close the wound.

b. Process of Le Dran.—Two Lateral Flaps.—Instead of making flaps before and behind, Le Dran makes them lateral, and gives them a semilunar form. This process has been described anew by M. Maingault, and justly condemned by Blandin.

c. First Process of M. Lisfranc.—Single Palmar Flap.—An incision is made through the skin at about one line in advance of the transverse crease, so as to enter the joint at the first stroke. The operator immediately divides the lateral ligaments, by inclining the bistoury a little first to one side and then to the other; the articulation being divided, there remains nothing more than to cut a palmar flap long enough to close the wound completely. In this way the operation is finished in the twinkling of an eye, and the cicatrix, carried towards the dorsal surface of the finger, is more advantageously situated than if on the front, an advantage which may be disputed, and is certainly more than counterbalanced by the risk of seeing the phalanx denuded behind. The disease besides is far from always permitting the operator to give the flap a sufficient length.

d. Second Process of M. Lisfranc.—The diseased finger is held in supination, the bistoury is passed flatwise between the soft parts and the front of the phalanx, and forms on being brought out a similar flap to that in the preceding method. The operator then raises up the instrument, and passes it through the joint from front to rear, without leaving any posterior flap.

e. Another Process.—Single Dorsal Flap.—When the disease prevents the formation of the flap in front, the first process of M. Lisfranc may be reversed, making the first incision at the distance of a line in advance of the palmar crease, and forming a flap at the expense of the dorsal surface of the finger But it is necessity, and not preference, that ever sends us to this operation.

f. Ordinary Process.—Two Flaps.—M. Richerand, Gouraud, and others, advise the formation of two semilunar flaps, one dorsal and the other palmar, each three or four lines long. Modified in a way which I shall now describe, this process appears to me to be of more general application than any other, and to be equally sure besides being more prompt in execution.

g. Two Flaps.—Palmar Flap longer than the other.—The operator seizes the diseased finger, flexes it slightly and draws it towards himself, whilst an assistant holds the root, bends the other fingers, or separates them from the first, and fixes the whole hand in pronation. With a narrow bistoury, held in the first position, the operator then cuts a small semilunar flap convex towards the nail, following throughout the passage of the anterior crease in the skin. The divided teguments are withdrawn by the assistant; the bistoury which is carried up with them opens the articulation by cutting across the extensor tendon, divides the lateral ligaments on the right and left, passes between the articular surfaces, avoiding as much as possible the projections which they present. Then, immediately upon arriving at the anterior ligament, the edge of the instrument is turned forwards, so as to glide upon the palmar surface of the disarticulated phalanx, and to form a flap of from four

to six or eight lines in length. The anterior flap is that upon which most reliance should be placed, although the other is by no means useless. In order that it should not be cut too short, nor left too long, I think that before finishing the division, it is prudent to imitate the practice of M. Delpech, in taking, so to speak, an exact measure by applying it against the surface which it is destined to cover.

2d. *Dressing and After-treatment.*—The operation being finished by one method or another, it is hardly ever necessary to tie or twist the arteries. The blood ceases to flow of its own accord, or with the assistance of a slight compression. But if the arteries should be tied, each thread should then be ranged in the corresponding angle of the wound: the two flaps being carefully brought together, are held in contact by one or two small diachylon straps, which embrace the stump loopwise and extend to the wrist upon the dorsal and palmar surfaces. A small rag pierced with holes and spread with cerate, some dry lint, a fine compress, and a narrow bandage to confine the whole, complete the dressing. A light diet for the space of two or three days, and afterwards aliment somewhat less copious and succulent than usual, is all that should be directed in regard to regimen. Provided the hand is carried in a sling, confinement to bed is not necessary, unless in case of accidents; the best means of preventing these, and of even arresting them when they begin to manifest themselves, is to establish an exact and regular compression from the fore-arm to the wound embracing the hand, properly padded on both surfaces.

§ 2. *Amputation of the Whole Finger.*

Some surgeons, and Lassus among the rest, have laid down the precept, that when the middle phalanx is diseased the first should be removed at the same time; because, say they, this being preserved alone remains immovable, and becomes a source rather of embarrassment, than of utility. To remedy this inconvenience, which he explains by saying, that after the removal of the second phalanx the flexor tendons lose their points of attachment, and the power of acting upon the first phalanx, M. Lisfranc makes, in the first place, one or two longitudinal incisions in front of the metacarpal phalanx, through the whole thickness of the soft parts, so as to determine the inflammation of the tendons and their adherence to the surrounding tissues; this, however, makes two operations of one; and as I have already remarked elsewhere, and M. Scoutetten since, the object proposed by M. Lisfranc is effected without operation by the fibrous cord which attaches one of the flexor tendons to the first phalanx of the fingers. But even if this anatomical disposition did not exist, the immobility described by Lassus need not be apprehended. After the cure, the extensor and the flexor tendons are always found fixed about the cicatrix, if not upon the bone itself, at least in such a manner that nothing hinders them from extending or bending the stump. And, in fact, observation proves that these fears are merely theoretical. It is not therefore right to amputate the whole finger, unless the disease has extended so far as absolutely to demand it, and will not permit us to amputate in the continuity, and saw the phalanx at a healthy point. Observing that after the operation the two collateral fingers find themselves kept apart in an unsightly manner by the head of the intermediate metacarpal bone, M. Dupuytren, with Messrs. Sanson and Begin, prefers the amputation of the latter bone in its continuity, to the simple disarticulation of the finger. But the patient is exposed to greater risk by this method than by the other; and

the head of the metacarpal bone after the disarticulation becomes flat, and permits the two adjoining fingers to come nearer to each other, so that it is wrong to pass the metacarpo-phalangeal articulation without absolute necessity. This amputation is only practised according to the oval and flap methods; the circular, vaguely indicated and followed by some practitioners, presents nothing but inconvenience, and should be rejected.

A. *Manual Flap Method.*—1st. *Process of Sharp.*—After having made a circular incision upon the root of the finger in advance of the commissure, Sharp makes another on each side in order to form a dorsal and a palmar flap before reaching the articulation. This method is essentially bad, and is never followed.

2d. *Process of Garengeot.*—The root of the diseased finger being first isolated down to the articulation by means of two lateral and parallel incisions, is then uncovered behind by a transverse or semilunar incision. There is then nothing more to do than to divide the extensor tendon and the sides of the capsule, to pass through the joint, and finish by cutting the flexor tendons and the skin which covers them. This is the method described by Bertrandi and others. That which has been substituted for it by many of the moderns, only differs in that, instead of being united by a transverse incision, the lateral incisions meet each other on the dorsal and palmar surfaces of the articulation.

3d. *Process of J. L. Petit.*—The base of the finger, circumscribed by two semicircular incisions, which pass over commissures and converge obliquely so as to meet behind and before, is at once exposed laterally as far as the articulation, which the operator opens and passes through either from one side to the other, or from front to rear.

4th. *By Puncture.*—Instead of cutting from the skin towards the bones, as just directed, Rossi plunges the bistoury through from the dorsal to the palmar surface, and cuts successively the two flaps from within outwards, that is, from their basis towards their free extremity. But this is a method which has no advantage over the others, and leaves a more irregular incision than that of Petit, of which it is nothing more than a repetition reversed.

5th. *Process of Le Dran, improved by the Moderns, and especially by M. Lisfranc.*—One or more assistants hold the hand turned in pronation and the healthy fingers, which they remove from the median line, at the same time keeping them extended. The operator seizes the diseased member with the left hand, moves it about a little in order to ascertain more exactly the situation of the joint, which the anatomical data given above enable him to discover. With the right hand he passes the heel of the bistoury, held in the first position, on the back of the articulation, or begins about four or five lines beyond; carries the incision of the skin to the middle of the commissure of one side, and by lowering the wrist prolongs the incision by a continuous movement to the line which crosses transversely the palm of the hand in front of the joint. The edge of the bistoury is immediately returned upon the convexity of the semilunar incision, to divide the soft parts down to the articulation, which is opened from one side by the blade of the instrument turned across, as soon as it arrives behind the head of the phalanx. At this point of the operation the assistant moderately draws the skin towards the wrist, and to the right or left. The surgeon turns the finger as if to luxate it; cuts the extensor and flexor tendons; causes the teguments to be drawn in the opposite direction, so as to keep them out of the way of the bistoury; and closes by forming a second flap, similar to the first, cutting from within outwards, and from the metacarpus to the interdigital commissure of the opposite side.

Remarks.—In order to allow the flaps greater length, Garengeot and others advise to begin the first and terminate the second a few lines in advance of the commissures. M. Lisfranc is of opinion that the upper part should be cut square, and not in a point, as is generally done. It has appeared to me that, by carefully bringing towards each other the bases of the fingers, the operator may very easily bring the two sides of the incision in contact, without having recourse to those precautions which by the way are no otherwise bad than as making the skin liable to be curled back upon itself, and as rendering the operation a little less easy.

After making the first incision, to avoid the risk of going beyond the head of the metacarpal bone it is well to feel with the index finger for the internal tubercle of the phalanx to be removed. This is an easy thing, since it is the first projection which is found in tracing the face of the bone into the palm.

It is well to prolong the first incision of the integuments nearly half an inch beyond the articulation. This makes it easier to cut the surrounding fibrous parts without touching the other lip of the incision, and enables us to cut the second flap more regularly.

When the operator has taken the precaution to graze the sides of the phalanx and to avoid passing the head of the metacarpal bone, the trunk of the collaterals is generally found preserved; he has then but two arteries requiring his attention, and which he may tie or twist, if the blood does not of itself cease to flow.

This is the quickest process, and presents no other inconvenience than that of not always giving to the last flap the same regularity, nor exactly the same form as the first. In this respect the process of Petit is to be preferred.

Oval Method.—The hand of the patient, the assistants, and the operator, being disposed as in the preceding case, the surgeon lays hold of the diseased finger with the left hand, gently flexes it drawing it at the same time a little away from the others, begins the incision on the dorsal surface farther back than the articulation with the heel of the bistoury, which he draws gently forwards to the edge of the commissure and with which he turns the palmar front of this finger, cutting exactly on the semicircular line by which it is separated from the hand, properly so called. Having arrived at the opposite border, he applies the bistoury again to the anterior or phalangeal extremity of the wound, and then draws it back obliquely towards the metacarpus, so as to unite the two extremities of the incision. Without quitting his hold upon the part to be removed, the operator causes the lips of the division to be separated as much as possible, cuts the extensor tendon, then the lateral ligaments and the posterior half of the articular capsula, increases the flexion of the finger, drawing it as if to disjoint it, passes the bistoury to its palmar face by traversing the articulation, and finishes by dividing the flexor tendons and the soft parts which unite the front of the phalanx to the cellular cushion of the palm.

Instead of turning the palmar side of the finger after reaching the commissure, it is more convenient to make the second incision in the same manner as the first; the disarticulation is then performed, and the rest of the operation, according to the directions just given. An incision in V is thus made, and the wound does not present an oval form until the end of the operation.

According to the oval method the trunk of the collaterals is seldom divided, and is consequently always easy to tie, if this is thought necessary. If too great an extent has not been allowed to the point of skin which is removed with the finger, the two lips of the incision meet without difficulty, and immediate reunion is rendered more certain and more sure by this than by any

other method. This, therefore, is the method which merits general adoption, inasmuch as it does not require that the skin should be healthy to the same extent as required by the others. The division which results, leaving the palmar cushion untouched, presents in reality a surface of one half the extent of that left by the flap method, and its regularity renders coaptation always easy. But to execute it well, it is necessary to possess positive anatomical knowledge, to be very skillful, and to have practised it upon the dead subject.

§ 3. *Amputation of the Fingers Collectively.*

Although amputation of all the fingers together had been performed before, M. Lisfranc was the first to give regularity to this operation, to show its advantages, and to describe its mechanism. The particular cases which require it may be easily conceived, without entering into further details; cases of this kind do occur, but it is very rarely.

Manual.—The hand and fore-arm being held, as for the amputation of a single finger, the operator lays hold of those which he wishes to remove, by placing the thumb across their dorsal, and the left hand upon the palmar face, flexes them moderately, and requires the assistant to stretch the skin by drawing it backwards. Then with a straight bistoury he makes a transverse incision, slightly convex forwards at about three or four lines below the extremity of the metacarpal bones, being careful to begin towards the index finger, if he operate upon the left hand, and towards the auricular in operating upon the right. This first incision lays bare the extensor tendons and the posterior face of the articulations. As soon as the integuments have been suitably drawn back, the surgeon opens the different articulations, passes through them, and divides their anterior ligaments. There remains nothing more for him to do than to pass in front of the heads of all the disarticulated phalanges a narrow knife, with which he cuts forwards a large semi-elliptical flap, naturally limited by the groove which unites the palmar face of the fingers with that of the hand. This same knife might also serve for the dorsal incision; but as it has to pass alternately upon the projections and the hollows, the bistoury is somewhat more convenient. To avoid the subsequent projection of the flexor tendons, it is necessary to cut them upon a level with the articulation before finishing the flap. The arteries opened in this operation are eight in number. As the operator bends them at an *angle* in raising the flap in order to close the wound, the use of the ligature is generally dispensed with. The palmar flap most commonly being the only one, and always of the greatest length, does not require to be united to the dorsal flap by suture. Adhesive straps suffice to maintain it, firmly applied against the heads of the metacarpal bones; a piece of linen pierced with holes and covered with cerate is next applied, and is in its turn covered with a thin layer of lint, over which is laid a fine compress and several narrow strips, which embrace the stump either directly or obliquely in the same direction as the plastic straps. After having suitably cushioned the palm of the hand, nothing more is to be done but to confine all these pieces with a bandage, which should extend itself by turns more or less close and moderately tight to just above the wrist, and pass once or twice between the root of the thumb, the rest of the hand, and the free extremity of the stump.

After the removal of a single finger, the same bandage, or nearly the same, is applicable. But it should make some difference whether flaps have been preserved or not. In the first case a narrow strip of diachylon fixes the pieces of skin over the end of the bone; whilst in the second it is sufficient to place one across, and to bring as near together as possible the roots of the two adjacent fingers, by pressing upon the edges of the hand with the bandage. The same is done when the oval method has been followed.

§ 4. *Accidents.*

However easy and trifling it may appear, the amputation of the fingers frequently gives rise to very serious accidents. A man and a woman died after this operation in 1825 and 1826, at the *Hopital de Perfectionnement*, and one of the patients upon whom I operated in 1831, at La Pitie, met the same fate. I could very easily adduce many such examples. It is sufficient to say that this operation should not be decided on without caution, nor for diseases which do not absolutely require it. The dangers arise from the inflammation which, through the intervention of the tendinous grooves, the sheaths, the synovial membranes, and of the very loose lamellar tissue of the dorsal and palmar faces, either of the phalanges of the hand, spreads with a frightful ease and rapidity in the direction of the wrist, involving at once the soft parts, the articulations, and the surface of the bones, which soon become the seat of a suppuration which nothing can arrest. To lay open the fibrous theca of each finger which has been amputated, as advised by Garengeot Bertrandi, and latterly by Barthelemy, would not in any way prevent the development of these dangerous inflammations, which are entirely independent of every thing like strangulation. When cataplasms or an abundant application of leeches fail to at once arrest its progress, nothing but numerous and deep incisions can give real relief. The remedy is indeed painful, but the question is of life or death; and no man who has had an opportunity of appreciating its sometimes miraculous effects, will hesitate an instant.

Art. 2.—Metacarpus.

Like the fingers, the bones of the metacarpus can be amputated in continuity or at the articulations, separately or together. They can also be partly cut out or wholly extracted, leaving the fingers which they support.

§ 1. *In the Continuity.*

If the first and last metacarpal bones are rarely amputated in the continuity, it is not so with those which support the index, middle, or fourth finger. These bones are swollen at both ends; concave towards the palm; convex and broader upon their dorsal face, which is only covered by the flat tendons of the extensor muscles of the fingers, a thin cellular lamina, veins, and the skin, and separated by smaller spaces in the direction of the wrist than elsewhere. They form all together a species of grate, bulging out behind, the concavity of which is occupied by the interosseous muscles, the tendons of the flexors, the lumbricales, the two arterial arches of the hand and the branches which

arise from them, the radiation of the median nerve, the muscles of the thenar and hypothenar eminences, the palmar aponeurosis, and the common integuments. They enjoy but little motion at their proximal articulations, but can be brought together so as to incline one before another at their digital extremity, whence it follows that when one of them has been obliquely sawn in the middle, it is easy to cause in a great degree the disappearance of the hollow which results, and that the deformity which follows such an amputation is less marked than after the simple removal of a finger. The phalangeal tuber continuing in the state of epiphysis until the age of from six to ten years, may, according to M. Lisfranc, be removed with the bistoury, from the hands of children, if the disease requires it, in amputating with one or all of the fingers. At a more advanced age, the saw is indispensably necessary. The scissors, the gouge, and the mallet, have been used for the removal of the bones of the metacarpus, the same as in the amputation of the fingers, although less frequently.

1st. *Amputation in mass.*—Louis performed the operation by means of the saw, so as to leave only the posterior moiety, for a young girl, who was very glad to keep the rest of the hand. Perhaps it would be better to cut them across in this way than to disarticulate them, if the extremity alone were affected. The operation could not be very difficult. A semilunar incision convex towards the fingers would expose the dorsal face of the metacarpus; a narrow knife pushed through flatwise from one edge of the hand to the other between the bones and the soft parts, could form a palmar flap of about twelve or eighteen lines in length; a bistoury might then disencumber each metacarpal bone of the tissues by which it is surrounded, so as to permit it to be sawn through with greater facility and neatness.

2d. *Amputation of a Single Bone.*—The parts being disposed and held in the same manner as for the amputation of a finger, the operator passes through the whole thickness of the hand from the back to the palm, several lines beyond the seat of the disease. In doing this he first causes the point of the bistoury, held in the third position, to fall perpendicularly upon the bone; then carries it a little to one side, cutting the skin in its passage; then turns it in a proper position to graze the side of the bone, brings it nearer to the median line as its point emerges upon the palm, and concludes the operation by cutting towards himself with the full edge to the middle of the corresponding interdigital commissure. After this first incision he makes another exactly similar on the opposite side, but in such a manner that the two should only form one in the rear; that is to say, that the thumb and fore-finger should draw the tissues to the left, while the bistoury, reapplied at the beginning of the first incision, is inclined so as to fall upon the first incision in the palm. The operator then cuts the soft parts which may remain attached to the bone, by exploring its whole circumference with the point of the instrument. A small splint made of wood, lead, or pasteboard, or a thick compress, is then thrust into the wound, so that the fine saw which is to divide the metacarpal bone with a long slope from front to rear, may not injure the flesh. The slope is to be replaced on the cubital side of the last two fingers and on the radial side of the first two, because of the particular species of motion which the carpo-metarcarpal articulation admits.

When the bistoury is not carried too far outwards, the collateral arteries

are not generally opened except at the base of the finger. In the contrary case the operator runs a risk of dividing the common trunk to the right and left, which does not generally prevent him from dispensing with ligature or torsion.

At the time of the dressing it is requisite to keep the lips of the incision somewhat near each other, by means of several circles of diachylon placed across, and of three or four turns of a bandage. In attempting to obtain a perfect coaptation the operator strains the posterior articulation, which may give rise to serious accidents; such as inflammation of all the synovial surfaces of the carpus, of the surrounding tendinous sheaths, &c. This operation, which is not sensibly more difficult than the disarticulation of a finger, produces a sanguineous surface, a wound three or four times larger; requires the division of soft parts, which are more delicate and more numerous, so that in this particular, at least, it is really much more serious, and recourse should not be had to it until after having fully ascertained the insufficiency of the other.

§ 2. *In the Contiguity.*

All the bones of the metacarpus may be disarticulated separately, and amputated with the finger with which they correspond. They may also be amputated all together or only the four last, at a single operation. But this kind of amputation is almost exclusively performed upon the first and the fifth, since it is much more easy to amputate the others in continuity.

A. *Metacarpal of the Thumb.—Amputation.*—The mobility of this bone and its shortness are reasons why it is scarcely ever sawn, and why disarticulation is preferred when this part is diseased. In all cases if its anterior extremity is alone affected, I do not see from what reason one could refuse to divide it immediately behind. No particular danger could attend this operation, which would not be difficult, and might be performed by the circular or flap method.

Anatomical Remarks.—The metacarpal bone of the thumb lying just beneath the skin, behind and on the outside, and concealed by the thickness of the thenar eminence in front, holds, at its carpal extremity, relations well worthy of notice. Its articulation with the trapezium lies in an oblique line drawn to the root of the little finger, and holds in some sort a middle place between the ginglymus and the enarthrosis. It is surrounded by a very loose capsule, may be opened in all points of its circumference, but principally by the two posterior or dorsal thirds. The tendons of the long abductor and of the short extensor of the thumb, garnish and support the part which is nearest the skin; the radial artery winds round the cubital side in its progress to the palm of the hand, to form the deep palmar arch. As for the tendons of the long flexor and extensor, their position in front and behind is too well known to require particular attention here. The situation of the joint is determined by sliding the fore-finger towards the wrist, along its dorsal face or one of its sides. It is immediately behind the first tuberosity which is encountered.

Manual.—The operator performs the operation of disarticulation of the first metacarpal in many different ways, and with ease by all, if he has any skill or address.

1st. *The Ancient Method.*—If the surgeon is not ambidexter, the hand of the patient should be held in pronation on the left side, and in supination on the right, otherwise, the operator places the hand in pronation for either side. Whilst the assistant clasps the wrist with one hand, and holds the roots of the last four fingers with the other, the operator lays hold of the thumb, and holds it in a state of abduction; applies the edge of the bistoury held in the first position with the point upwards against the middle of the commissure; divides the whole thickness of the soft parts, grazing the cubital border of the bone as far as the carpus; extends the incision of the teguments from four to six lines upon its dorsal and palmar surfaces, towards the wrist; opens the joint with the bistoury turned outwards; divides all the fibrous parts with the point rather than with the edge of the instrument, so as to avoid the skin; turns the thumb at the same time to the radial side, luxes it, and after having passed through the articulation, cuts the flap towards himself, grazing the external surface of the bone, and extending it to some lines in advance of the metacarpo-phalangeal articulation. In order to preserve for this flap particularly, at its base, a sufficient breadth and thickness, it is advantageous in passing through the interosseous space, to incline the handle of the bistoury a little to the hypothenar eminence, and to direct the edge towards the os-pisiforme, or the cubital border of the carpal extremity of the radius. By extending the incision of the skin to some lines beyond the carpo-metacarpal articulation, you secure the means of disjointing the bones, without bruising or cutting the edges of the flap which is to cover the wound.

If the radial artery itself has been injured, the use of the ligature is requisite; otherwise, an exact coaptation of the surfaces will render this useless. After having applied the adhesive straps, it is well still to lay a quantity of lint, or a graduated compress upon the external face of the flap, the base of which requires to be strongly pressed against the second metacarpal bone.

2d. *Another Method.*—An assistant is charged with the thumb; the surgeon seizes with the first three fingers of the left hand and draws outwards as much as possible the soft parts, plunges the bistoury by puncture from the dorsal to the palmar face of the thenar eminence, gliding along the radial side of the articulation, cuts a flap as before directed, turns it back, and causes it to be held by the assistant. He then takes the thumb himself, separates the lips of the incision, passes through the articulation from the outer to the inner side, luxes the bone, and terminates the operation by bringing the bistoury to the same point where the preceding operation should commence. As the definitive result is exactly the same in both cases, and as by the latter method it is always inconvenient to effect the disarticulation, the former should be preferred. Instead of forming a flap from within outwards, by puncture, one might cut it in the opposite direction, that is, begin by the division of the teguments, and then dissect the flap backwards from its free extremity to its base. This would allow it with more certainty all possible regularity, and just the dimensions required.

3d. *New Process.*—I have often amputated the thumb in the following manner:—A dorsal incision carried from the styloid apophysis of the radius to the commissure of the thumb and fore-finger, dividing the integuments, the tendon of the long extensor with a part of the first interosseus muscle at once exposes the articulation. Whilst the assistant separates the lips of

the incision, the surgeon divides the capsule, luxes the bone which he then removes, preserving as much of the thenar eminence as is necessary for the immediate closing of the wound. The palm of the hand being thus respected, permits a flap to be made of the form and extent required, without having any special obstacles to surmount.

4th. *The Oval Method.*—Lassus, Beclard, and Richerand, have many years ago described this method of amputation. The operation is begun in the manner just described. The operator turns the anterior face of the root of the thumb, comes up upon its dorsal face, and unites this second part of the incision to the extremity of the first. In the second step he carries the point of the bistoury upon the joint through which he passes from the dorsal to the palmar side, after which nothing more remains than to detach the bone from the flesh which adheres to it, by sliding the instrument between them from the wrist forwards. A very long oval incision is thus obtained, the lips of which may be united with the greatest facility, leaving nothing between them but a simple linea trace. It is the most simple and the best of all known methods, but is somewhat more difficult than the preceding, which gives nearly the same results.

Extraction.—We may conceive that this bone may suffer necrosis, or become careous, without affecting the thumb or the carpus, and it would be important to be able to remove it and at the same time to preserve all the other parts. M. Troccon advocates, in a memoir presented to the institute in 1816, the possibility of this extraction; but M. Roux appears to have been the first to use this method successfully upon the living subject. The thumb of his patient which at first was rendered entirely useless, recovered by degrees its natural functions, so as to be able to execute quite extensive movements. I know a person, in whose case the first phalanx was affected with necrosis, and extracted by fragments, without impairing to any great degree the motion of the thumb. I was myself ignorant, in 1825, of the fact that this operation had been mentioned by M. Troccon; and as M. Roux has nowhere described his operation, I thought proper to enter into some details as to the best method of procedure, in my work on surgical anatomy. This operation having been performed successfully, in 1827, by M. Blandin, may at the present period be ranked with the regular operations.

An incision is first made parallel to the radial border of the bone to be removed, and is extended at least half an inch behind and before both its articulations. The operator then carefully detaches the teguments and the tendon of the long extensor from its dorsal face; the same operation is performed upon the opponens muscle and the long flexor which cover its palmar face. While an assistant forcibly separates the two lips of the wound, the surgeon introduces the point of the bistoury upon the external side of the carpal articulation; divides the tendon of the long abductor; does the same with the short extensor, always cautiously avoiding the long extensor of the thumb; destroys all the ligaments and fibrous parts which connect the metacarpal bone to the trapezium; endeavors to lux this bone outwards, either by a simple swaying movement or by drawing it in that direction with the forceps; takes it then in his fingers, passes the bistoury along its cubital side to separate it from the flesh, and disarticulates it by dividing successively the internal and external lateral ligaments, and then the anterior fibrous strata which unite it

to the thumb, which is left supported by its long extensor, long flexus, short abductor, short flexus and adductor, preserving in short the whole thickness of the thenar eminence. No artery of any size need be opened. The usual dressings are applied, with the addition of lint or compresses so placed as with the aid of the bandage to keep the thumb in its natural position.

B. *Fifth Metacarpal Bone—Amputation.*—The bone which supports the little finger is removed by the same methods as that of the thumb. Its articulation with the os-unciform lies obliquely, in the direction of a line which would fall in front of the articulation of the trapezium with the first metacarpal bone, and it is connected with that which supports the fourth finger by a facet nearly plane, and two or three ligamentous bands. Its situation is recognized from without, by following the dorsal face of the bone with the end of the fore-finger. Before coming opposite the os-pisiforme, the operator meets a slight protuberance, and immediately after a slight depression, which falls exactly upon the line of the articulation.

1st. When the *Process of the Ancients* is followed, there is no danger (as in the case of operation on the thumb) of seeing the bistoury entangled between bones in the carpus. It may therefore be carried boldly as far as the unciform bone, along the radial side of the bone to be removed, with the edge directed toward the median line of the wrist, in such a manner as to preserve almost entire the hypothenar eminence. After the inter-metacarpal ligament is divided, the point of the bistoury, which is then inclined towards the ulna, easily enters the articulation. As the other fibrous tissues are divided, the finger should be bent to the ulnar side, so that the instrument may clear the articulation, and isolate the base of the flap. This is cut forwards, extending beyond the metacarpo-phalangeal articulation, while the little finger is returned nearly to its natural position.

2d. *The Second Process*, which is begun by forming a flap, by passing through the flesh from one face to the other of the hypothenar eminence before having separated the fifth metacarpal from the fourth, belongs, I believe, to M. Lisfranc. It must be admitted that it is here more advantageous and easier of application than on the other border of the hand. The soft parts are better adapted to the formation of a sufficient flap by this method; but the disarticulation is here, as there, more difficult than by the preceding method.

3d. The process which I sometimes adopt in amputating the metacarpal bone of the thumb, does not always apply with the same advantage to that of the little finger, where the oval method is evidently better. The incision being commenced before the styloid apophysis of the ulna, is carried obliquely along the edge of the hand as far as the root of the little finger, and passes round the palmar face of that member from the ulnar to the radial side. This incision stops at the commissure, but by a second application of the bistoury, is prolonged upon the back of the hand, so as to meet at an acute angle with the first part of the incision. It would be equally easy to begin so as to fall upon the commissure of the last two fingers, and finish by an internal incision. The disarticulation has nothing peculiar.

Extraction.—This bone, as well as the metacarpal of the thumb, may be extracted and that quite easily; but as the little finger is not of so much importance as the thumb, it will perhaps always go with its metacarpal bone,

whenever that shall require to be removed. But if this bone is to be separately removed, it may be done by a method precisely analagous to that recommended for the extraction of the corresponding bone on the other side of the hand, beginning with a dorsal incision from the head of the ulna to the middle of the ulnar side of the little finger.

Central Metacarpal Bones.—Amputation.—Although not absolutely impracticable, the disarticulation of these three bones is, it must be confessed, much more difficult than that of the first two, so that surgeons generally prefer to amputate in continuity. Still, if it is thought best to have recourse to it, this operation may be performed by means of the flap or oval method.

1st. *Flap Method.—Metacarpal Bone of the Index.*—The bistoury, carried from the commissure to the carpus, soon arrives at the ligament which connects this bone to the metacarpal of the medius. It is then raised so as to cut the dorsal ligament, and lowered to divide the palmar ligament; the finger is inclined towards the thumb, the articulation opens, the point of the instrument crosses it, and the operation is finished by forming a flap on the radial side, which should extend farther forward than the metacarpo-phalangeal articulation.

Metacarpal Bone of the Medius.—The bistoury is carried between the two middle fingers. The operator before attempting the disarticulation, should extend the incision in front and behind towards the wrist, to the distance of about half an inch, turning it somewhat towards the median line; this joint being in a position rather oblique from the ulna towards the radius, and from before backwards, would occasion much more difficulty if the operation were commenced on the other side. When the dorsal and palmar ligaments have been divided; when the bone which is to be removed has been separated from that of the ring-finger, the surgeon acts upon the anterior extremity, as if to disjoint it at the other; he then endeavors, while the assistant draws the lips of the incision towards the thumb, to disengage its carpal extremity, to which the tendon of radialis brevior is attached. This being done, the full edge of the bistoury is rapidly passed along the radial face of the bone, as far as the commissure of the index and the medius.

For the *Fourth Metacarpal Bone*, the surgeon should carry the bistoury through the same interspace; prolong the incision toward the wrist in the same manner, but with this difference, that he incline it toward the ulna, separate the two contiguous osseous facets, divide the ligaments as in the preceding case, and bear in mind that the articulation of this bone with the magnum and the unciform, is oblique from the radial to the ulnar side, and from before backwards, and that it is continuous with that of the fifth.

2d. *Oval Method.*—M. Langenbeck was the first to practise with success the extirpation of one of these bones by the oval method. The operator divides the integuments upon their dorsal faces, beginning half an inch beyond the carpal articulation; extends his incision to one of the digital commissures; brings it back on the other side, by turning the palmar front of the root of the finger, and then unites the two extremities of the incision, cutting towards the wrist, or he may cut from the wrist, making an incision similar to the first, on the other side of the bone which is to be removed. Whilst the assistant separates as much as possible the lips of the wound, the surgeon cuts successively and without violence with the point of the bistoury, the liga-

ment of the articulation, and with the other hand endeavors to disjoint the bone. When at last this has been effected, the bistoury, held in a flat and horizontal position, slides along the bone so as to divide from the carpus towards the root of the finger all the soft parts which are still attached to its palmar face.

Extraction.—M. Troccon has not only advised the separate extraction of the metacarpal bone of the thumb; he thinks that the same operation should be attempted upon the others. I have frequently practised it upon the dead subject, and I must say, that with an exact knowledge of the anatomy of the articulations, it may be done without much difficulty. An incision is carried from the carpal extremity of the fore-arm to the distance of about half an inch in advance of the phalangeal articulation, carefully avoiding the extensor tendon. In order to disarticulate the bone at its proximal extremity, the operator acts as in the preceding cases; after luxing it, he seizes it with two fingers, or with the forceps, while with the point of the bistoury he proceeds to divide the posterior part of the capsule, the lateral ligaments and the anterior ligament of the other articulations, carefully avoiding in every instance the extensor and flexor tendons of the corresponding finger.

Instead of beginning at the proximal extremity, as advised by M. Troccon, I think, with Mr. Blandin, who revived the idea in 1828, that it would be better, first, to disarticulate the phalangeal extremity, and to close the operation by dividing the carpal ligaments; but it is probable that notwithstanding the success obtained by Mr. Walther, this operation will continue to be, for a long time to come, a mere project with the greater part of the practitioners. The division of the diseased bone, I think, may almost always be advantageously substituted for it.

E. *Disarticulation of several, or of all the Bones of the Metacarpus together.* When the whole hand is found to be attacked but in such manner as to leave the carpo-metacarpal articulation untouched, is it necessaryto remove the wrist? If all the dogmatical treatises on surgery are to be believed, there could be no doubt upon this subject, or rather it is a question with which their authors have not troubled themselves. In disarticulating only the metacarpal bones, the operation preserves a greater length for the fore-arm, a movable portion of the limb, and undeniable advantages in the application of an artificial hand. M. Larrey affirms, that for a long period the military surgeons have had recourse to this operation; M. Yvan also remarks, that several soldiers in the Hospital of Invalids have submitted to it, and always with success. And a number of other authors might be cited to prove the operation practicable, although they do not always consider it advisable. In every instance where it is possible to preserve the thumb or any other finger, by means of it, there is no question of the propriety of resorting to it. As a general rule, the disarticulation of the carpus from the metacarpus should be preferred to the amputation of the wrist. It cannot be denied that after the cure the carpus can be of very great advantage to the patient, even if he do not desire to make use of an artificial hand. But this is an operation which requires practice and very precise anatomical knowledge; so that if the surgeon is not sufficiently confident in himself to perform it securely, he ought not to undertake it.

1st. *Anatomical Remarks.*—The relations of the first and fifth metacarpal bones with the trapezium and the unciform, have been already discussed.

The metacarpal bones of the index finger is loosely connected externally with that of the thumb; more firmly within with the third; and presents behind and externally a tuberosity which extends some lines towards the wrist and gives attachment to the tendon of the radialis longior. Its proximal extremity is articulated externally to the trapezium, and by its two internal thirds to the trapezoides. The third metacarpal also presents a tuberosity, which tends to slide behind the line between the os-magnum and the os-trapezoides, and gives attachment to the tendon of the radialis brevior. Its proximal surface being oblique from the radial to the ulnar side, rests upon nearly the whole extent of the corresponding front of the os-magnum; while that of the fourth, having a similar slope inwards and backwards, is connected with the radial half of the anterior surface of the os-unciform, then to a similar surface presented by the os-magnum, and forwards and towards the ulnar side.

All these bones are held together by means of dorsal ligaments in the form of longitudinal and transverse bands, by palmar ligaments much more irregular, and by fibrous fasciculi, which fill the spaces between the points of their proximal extremities in the palm. Their synovial cavity is continuous with that of the carpus, and consequently extends between the two ranges of that part, so that inflammation of the osseous surfaces after this amputation must indeed be excessively dangerous. Looking at all these articulations on their dorsal face, it is perceived that that of the first metacarpal bone being oblique forwards and inwards, terminates one or two lines before that of the second, the line of which turning at first almost directly backwards, soon becomes nearly transverse; before leaving the trapezium, and with a semilunar sweep, concave forwards, arrives upon the trapezoides. It then turns obliquely backwards before leaving this bone, and joining the third metacarpal. The articulation of this latter begins about half a line nearer the wrist than the termination of that of the second, and proceeds obliquely inwards and forwards in a line which would fall upon the posterior quarter of the fifth bone. It terminates two or three lines nearer the fingers than the commencement of the articulation of the fourth. This follows at first such a direction, that if continued it would be lost in the pisiforme bone, then takes a transverse direction on arriving upon the unciform, and continues with scarce a line of demarcation into that of the last metacarpal, which is also somewhat oblique to the rear. The mode of ascertaining from without the situation of the first and fifth of these articulations, has been already described.

2. *Manual of the Operation.*—A. *Process adopted by the Author.*—An assistant supports the fore-arm, and compresses at the same time the ulnar and radial arteries; the hand of the patient being turned in pronation is clasped by the operator, who seizes only the four fingers when he wishes to leave the thumb. With a straight bistoury or a small knife he makes a semilunar incision convex forwards, about half an inch in advance of the articular line, which has just been described. The assistant then draws the skin in the direction of the fore-arm. With a second stroke of the bistoury, the surgeon then divides all the extensor tendons, and immediately proceeds to the disarticulation. Beginning on the radial side, if he is operating on the left hand, and on the ulnar, if he is operating on the right, he draws the point of the bistoury along all the windings of the dorsal aspect of the articular line, for there is no need of penetrating it to divide the ligaments.

During this manœuvre, the operator acts with some force upon the anterior extremity of the hand, as if to disjoint it. All the articulations being once opened, the point of the bistoury is reapplied, in order to divide any fibres which may still connect them. When they are completely separated, the knife glides by degrees towards the palm of the hand, assumes a horizontal position, and cuts a flap in the shape of a half-moon, of the length of an inch or an inch and a half, grazing the palmar face of the metacarpian bones, which are to be removed. The terminating branches of the radial and ulnar arteries have necessarily been divided. Those of the former are found upon the dorsal aspect of the wrist, and near its radial border; the second should be sought for on the internal side of the pisiforme bone. Immediate union, which is of the greatest consequence, requires the same precautions as are used in cases of simultaneous amputation of all the fingers at once.

b. Proceeding of M. Maingault.—This author would have the surgeon to begin by forming the palmar flap with a small knife, inserted between the bones and the soft parts of the hand. A semicircular incision is then made upon the dorsal face of the metacarpus, at about one inch from the articulation, and while an assistant draws back the flaps, the operator, leaving his posterior incision, exposes in front the articular line, and passes through the joints from the palm to the back of the hand.

The experiments I have made with this process have satisfied me that it is not very difficult. But it appeared to me, whether from want of skill in me, or from real imperfection in the process, that the other was to be preferred.

If the first two or the last two metacarpals should require to be removed by themselves, the operation must be subjected to some modifications. It would be necessary in the first case, for example, to begin by making a transverse incision a little in front of the articulations, then to make another parallel to the axis of the metacarpal bones upon the back of that which supports the little finger, so as to make there a dorsal flap to cover the whole ulnar side of the wound after the operation. That being done, and the disarticulation being effected, the operation is finished by forming a flap one or two inches long, which must be detached down to its base from the palm of the hand, so that it may be applied upon the transverse branch of the wound. The operation is nearly the same for removing the thumb and the index, or the index and the medius.

In case the operator wishes to remove at the same time some of the bones of the carpus, no rule can be laid down beforehand. The surgeon must rely upon his own knowledge and resources for these trifling operations.

Art. 3.—*The Wrist.*

At the present day, according to Percy, it is only at Tunis and such like places that they use, in amputating the wrist, like the ancients, a hatchet moved by a weight falling from above between two grooved uprights, or of a strong chisel, which the operator strikes with a leaden mallet. Let us add that there is no person who now believes in the propriety of amputating the fore-arm, when to remove the disease entirely it is sufficient to disarticulate the hand. Amongst the moderns, there are many surgeons to be found who consider this latter operation dangerous; the facts reported by Slotanus,

Hilden, Paignon, Leblanc, Audouillet, Hoin, Sabatier, Brasdor, Lassus, M Gouraud, and others, who affirm that it almost always succeeds, have not entirely dissipated the fears which it had previously inspired.

Anatomical Remarks.—The radio-carpal articulation is surrounded by numerous tendons, sheaths, and synovial membranes, and presents also this circumstance worthy of remark, that it terminates at both extremities of its greater diameter in the apophyses of the radius and of the ulna, which give it the form of a half-moon, transversely concave, slightly concave also backwards, lodging a species of head formed by the scaphoides, the semilunare, and the trapezium; and held in place by internal and external posterior and anterior ligaments. As the first range of the carpus diminishes towards its extremities, particularly towards the cubital side, a line drawn transversely from the styloid process would easily fall between that range and the second; the pisiforme, the point of the scaphoides, the crest of the trapezium, and that of the unciform bone, jut out beyond the level of the palmar front of the radius and of the cubitus, far enough to command attention at the time of operation. The skin of the anterior face of the wrist presents, almost constantly, three wrinkles, which may be of great use in directing the course of the instruments. The first, which is the most constant, is found immediately above the thenar and hypothenar eminences, and corresponds with the line between the two ranges of the carpal bones: the second, which is perceived from four to six lines in the rear, falls upon the radio-carpal articulation, and the third, still higher towards the elbow, commonly corresponds with the junction of the epiphyses with the shafts of the radius and ulna. When these wrinkles are imperfectly developed, bending the hand is generally sufficient to display them more fully.

Manual.—The amputation of the wrist is only practised by the circular or flap method: the disposition of the articular surfaces, and the thinness of the soft parts, render the oval method inapplicable.

A. *Circular Method.*—The surgeons of the last century contented themselves with saying, that the amputation of the wrist should be effected in the same manner as that of the fore-arm or of the leg, without entering into any further details on the subject, so that it may be concluded that they used the circular method, which has been clearly described by J. L. Petit, the only one indicated by Lassus, and Sabatier, and that which still presents the greatest advantages and the greatest facility. The assistant who has charge of the fore-arm, draws the teguments forcibly backwards; the surgeon seizes the hand of the patient, holds it in a flexed posture, while he cuts upon the dorsal face; inclining it towards the radius, while he cuts on the inside; towards the ulnar, when on the outside; and in extension, the moment the instrument is passed below. In this manner he makes an incision regularly circular, a full finger's breadth in front of the apophyses of the fore-arm, through the skin only, which it is then easy to push back to the vicinity of the articulation. A second stroke divides all the tendons at the edge of the retracted teguments. He then enters the articulation by one or the other of its sides, taking the corresponding styloid apophysis as a guide, and passing the bistoury in a line convex towards the arm.

The radial and cubital arteries, which are easy to find and to tie or twist, have often been left in the wound without precaution and without occasioning

subsequent hemorrhage. As to the interosseal artery, it is too trifling to merit any attention. If the operation has been properly performed, there will remain enough of the integuments to enable the operator, without much effort, to bring them forwards, and to cover completely the articular surfaces. It is here particularly, that Garengeot and Le Blanc recommend incision of the tendinous sheaths to the extent of one or two inches, in order to avoid purulent collections. It is here too, that the depending posture of the stump seems to me to be particularly indicated.

B. *Flap Method.*—1st. *Old Process.*—The surgeons of the army have for a long time, it appears, practised an operation, described by M. Gouraud in 1815, which consists in making upon the dorsal face of the wrist a semilunar incision convex towards the fingers, and corresponding by its extremities with the apophyses of the radius and the ulna. An assistant then withdraws the cutaneous envelope. The operator divides the filaments which connect it with the subjacent tissues, and with a second incision in the direction of the articulation, severs all the extensor tendons and the posterior radio-carpal ligament. He then cuts the lateral ligaments, the tendons of the posterior radialis, and ulnaris muscles, if it has not already been done. It now remains to pass through the joint with a narrow knife, which is brought in front of the carpus, so as to finish by forming a flap of about an inch in length. Some surgeons advise that this flap should be extended about two inches from its base, and consequently cut it forwards at the expense of the thenar and hypothenar eminences. When enough of the skin has been preserved at the commencement, this precaution would be more disadvantageous than useful. In order to cut the flap with facility, and to give it all possible regularity, the operator should early incline the edge of the instrument towards the integuments, so as to avoid coming in contact with the osseous protuberances of the carpus, and to remove the pisiforme at the same time with the hand. As the flexor tendons form here a considerable bundle, the operator should not hesitate, in case of resistance, to pass the instrument beneath them, and to divide them transversely. The coaptation of the lips of the incision cannot fail to be rendered more easy. This process, equally prompt and simple, possesses the advantage of permitting us, in case the soft parts behind are disorganized, to preserve a sufficiency in front to close the whole division. It is still, however, subject to the inconvenience of exposing the osseous angles to denudation, and occasioning sometimes an overlapping of the lips of the wound; for it is precisely at the concave and least salient point of the articulation, that the thickest and broadest parts of the flaps are applied.

2d. *Process of M. Lisfranc.*—The hand and the fore-arm are placed in supination, and held so by the assistant, who at the same time compresses the radial and ulnar arteries. The operator being provided with a narrow knife pierces the tissue from the radius towards the ulna, or *vice versa*, according as he may have to do with the right or the left wrist, opposite the styloid apophyses, passing thus between the soft parts and the anterior face of the carpus, draws the instrument towards the hand, and cuts as in the preceding case a semi-elliptical flap, about two inches long. This being drawn up, or turned back, permits the surgeon to make immediately a semicircular incision upon the dorsal face of the wrist, something like that which I have just described; to divide at the same time the extensor tendons, almost to a level with the joint;

then to disarticulate, by passing under the point of one of the styloid apophyses, and to finish as in the circular method.

In attempting to describe the process of Lisfranc, the editors of Sabatier have unwittingly introduced a slight modification. After having formed the palmar flap, instead of carrying the knife behind the wrist in order to divide the integuments, they advise to pass at once through the joint from the palmar side, and finish by dividing the tissues which cover the back of the carpus. In either way this method presents nearly the same inconveniences and the same advantages as the flap-method generally followed, from which it only differs in circumstances too trivial to merit here a further discussion.

Art. 4.—*The Fore-arm.*

Anatomical and Surgical Remarks.—The law which requires us to amputate at the greatest possible distance from the trunk, which is applicable to every amputation performed on the thoracic member, is especially so in regard to the fore-arm. J. L. Petit, Le Blanc, Bertrandi, and more recently, M. Larrey, founding their opinions upon false appearances and upon positions badly sustained, have however advanced the contrary. According to them, the inferior third of that part is not sufficiently fleshy, encloses too many fibrous tissues to permit the bone to be easily covered after amputation, and a thousand dangers are incurred by making incisions there. The superior half, on the contrary, being furnished with numerous muscles, and without tendons, presents the most advantageous conditions which could be desired for the success of such operations, and should consequently be preferred at the risk of sacrificing some inches of tissue, which might perhaps be otherwise preserved. To this reasoning it may be replied that, all circumstances being alike, the farther you operate from the root of the member the less the flesh is divided, the less extensive the bleeding surface, the less violent the general reaction, the fewer the accidents to be apprehended: that the most meagre part of the fore-arm and the most completely devoid of the muscular fibres, will always permit the operator to preserve a sufficiency of skin to meet and completely close the wound. I will repeat that when it comes to the proof, it is always the integuments that form the cicatrix, and that they are even better, more pliant, and more firm, when they are farthest removed from tendons or muscles. But this is a question which experience seems to have already and finally decided, for I do not see that any person thinks of again bringing it under discussion.

Besides the twenty muscles and their tendons, the radial, cubital, and interosseal arteries, with the corresponding nerves, and the median and the aponeurosis and superficial veins, which are presented over its whole extent, the fore-arm offers for consideration—1st. Its two bones, movable one upon the other, separated by a space diminishing as you approach either extremity, and which by the assistance of a species of membraneous diaphragm, form the floors of the anterior and posterior excavations or fossæ. 2d. A series of fibrous intersections and an abundance of lamellar tissue between the two fleshy strata, the attachments of which permit but an inconsiderable retraction, at the same time that the whole collection of these different objects could

hardly have been made more favorable to the development of phlegmonous inflammation and of purulent collections.

Manual—A. *Circular Method.*—All the varieties of the circular method, that of Celsus, of Wiseman, and Pigray, those of Petit, of Le Dran, or Louis, of Alanson, and of Desault, have been or are still used in the amputation of the fore-arm. That most generally followed at the present day, and in my opinion, the best, is practised thus:—

1st. *Process adopted by the Author.*—The patient is supported on the edge of his bed, or upon a chair, if he is not too much enfeebled. An assistant stationed behind his shoulder presses the brachial artery against the humerus below the arm-pit, with the four fingers of one hand, either directly or by the intervention of a pledget or rolled bandage, whilst the thumb gives a counter-support beneath, unless the operator should prefer the use of the tourniquet or of the garot. A second assistant, or even the same if circumstances require it, holds the fore-arm turned in pronation, and is ready at the proper moment to draw the skin towards the elbow. The member to be removed, wrapped in a linen bandage, should be supported by a third assistant. With the left hand the operator, placed in front, takes hold of the fore-arm above the point where the skin is to be incised if it be upon the left side, below, if on the right, unless the operator be ambidexter. He then divides circularly the external envelope to the aponeurosis, two or three fingers' breadths below the place where the section of the bone is to be made. If any cellulo-fibrous filaments hinder the retraction of the integuments, the operator divides them rapidly, and immediately returns the knife with a circular sweep, as in the first instance, upon the external and posterior face of the radius, cuts the whole thickness of the flesh as near as possible to the retracted skin, first on the dorsal region, then on the palmar, and in the third place on the radial. In order to prevent their yielding or slipping, instead of being cut it is necessary that the instrument divide them with a sawing movement, without leaving the surface of the radius until it rest fairly upon the ulna, which it should also carefully graze as it passes round to the palmar side, if the operator desires that no portion should escape him and present itself again behind. I need not say that the same precaution is equally necessary for the rest of the circumference of the limb. The divided muscles retract more or less: the knife is brought backwards upon the dorsal face of the cubitus, and then drawn towards the operator; its point glides upon the posterior interosseous fossæ, through which it is plunged deeply, and returns, dividing every thing it meets, upon the posterior face of the radius around which it turns. It is then carried beneath, in order to effect in front what has just been done on the back of the member; nothing then remains around the bones. The middle head of the three-headed compress is immediately carried with the forceps through the interosseous space, from the palmar to the dorsal side. The fleshy parts being thus protected and drawn back, the surgeon proceeds to divide the bones; begins with the radius, continues by operating at the same time upon the radius and the ulna, but in such a manner as to finish with the latter. After the removal of the part the triple compress is taken off, and the assistant charged with the retraction of the soft parts immediately relaxes them. The surgeon then occupies himself in searching for the arteries, one after the other, in the midst of the tissues; the anterior interosseal, accompanied by a nerve

which it is well to avoid, is found nearly upon the middle of the palmar face of the ligament of the same name. The radial, situated more to the outside and more superficially, is seen between the supinator longus, the flexor radialis, and the flexor longus pollicis. It is so far removed from the nerve as not to require, in this respect, any particular precaution in tying it. The ulnar artery lies towards the inner side, between the flexor ulnaris, the flexor sublimis, and the flexor profundus, having the nerve on its internal side. As to the posterior interosseal artery, which is distributed throughout the fleshy mass of the extensors, it needs no attention, unless the amputation have been performed towards the superior half of the fore-arm. The wound should be closed from behind and before, and it is in this direction that the adhesive strips are to be applied. A transverse linear wound is thus formed, the angles of which cover the bones and give exit to the remaining parts of the corresponding ligatures, whilst that of the centre should be immediately brought directly out at the middle of the wound.

2d. *Process of Alanson.*—If the skin were diseased, or had contracted morbid adhesions with the subjacent tissues, it would be better, after having made the incision, to dissect it up and turn it back upon its external face like a ruffle, after the manner of Alanson.

3d. *Process of M. J. Cloquet.*—When there is reason to apprehend some difficulty in dividing the muscles and tendons which lie in the interosseous fossæ, the surgeon may pass the knife flat between the bones and the flesh, and immediately turn the edge so as to cut transversely outwards all the soft parts on a level with the retracted integuments, and that upon both aspects of the limb successively. M. Hervez de Chegoin, I believe, first published, in 1819, the idea of this modification, which M. J. Cloquet assures us that he has applied many times with success; and which, through inadvertence no doubt, the editors of Sabatier have appropriated to themselves.

Remarks.—When all the muscles have been divided, some may desire to cause them to retract so as to admit of sawing the bones at a higher point. In this case they should detach for a few lines with the point of the knife, or with the bistoury, the two edges of the interosseus membrane. Here, as upon all the other parts of the member, we should preserve an extent of teguments the more considerable the higher we perform the operation; or rather, the greater the volume of the part. It should be remembered too, that the deep muscles which are attached to nearly the whole extent of the bones, retract but little towards the elbow, and that we must depend principally upon the skin for closing the wound and covering the stump.

B. *Flap Method.—History and Appreciation.*—The circular amputation of the fore-arm generally succeeds extremely well, and admits of a cure in three or four weeks; yet surgeons have advised replacing it by the flap method. M. Græfe, has in our own day performed it according to the advice of Verduin and Lowdham, and as Ruysche declares that he had seen it performed in his presence; that is, by cutting a flap upon the palmar front of the limb, and concluding the operation according to the circular method. Vermale, Le Dran, Klein, Hennen, and Guthrie, prefer, on the contrary, to make two flaps, one in front, and one behind. In this respect we can hardly refuse preference to the method followed by Vermale, over that of Verduin. I have tried it myself, and have caused it to be performed by many of my pupils, upon

the dead subject. I have twice operated in the same way upon the living subject, and remain convinced that it is generally less advantageous than the circular method, although the operation is more easy and more quickly finished. It is very true, that it gives fleshy fibres to cover the ends of the bones. The flaps are thick and abundantly furnished with cellular tissue, to fit together exactly, and to provide with certainty for all the exigencies of immediate union. Two inches are sufficient for each, in order to enable them properly to meet; if the disease extends farther upon one side than the other, it is easy to make but one flap, or two of unequal length; so that it cannot at first be seen why this method would not permit amputation as low as the circular method. Unfortunately, in looking more closely, it will soon be perceived that these advantages are illusory; all the muscles are cut obliquely, and this necessarily increases the traumatic surface. They are preserved in the thickness of each flap, only to increase the danger of inflammations which may then develop themselves. The bones are not the less exposed to escape by the angles of the solution, and the slightest reflection will show, that by a circular incision an inch of teguments will close with more exactness a wound two inches across, than flaps half as long again, because of the opening which the flaps are so prone to leave upon each side of their base: nevertheless, here is a manual of the operation.

2d. *Manual.*—The limb is turned in pronation, and held in a convenient position. The operator cuts the palmar flap, by passing his knife from one side of the fore-arm to the other between the bones and the soft parts, which he divides obliquely towards the wrist. In order to form the dorsal flap, he draws the lips of the wound backwards, returns the point of the knife to the superior part of the first incision, passes it behind the bones, and finishes with the same precautions as before. He then directs the assistant to turn back immediately all the fleshy parts, cuts around the radius and the ulna, and with the assistance of the divided compress divides these bones as directed in the circular operation.

3d. *Remarks.*—Cutting the anterior flap first allows a greater thickness to the dorsal, and as the palmar side of the fore-arm is turned downwards, the blood which at first escapes does not at all interfere with the rest of the operation; but this precaution is far from being indispensable. The important point is to obtain two flaps of nearly equal dimensions, and to avoid cutting them out too much at the angles. The operator may also leave the limb in supination instead of turning it after the first stroke into pronation, but then the division of the bones will produce a greater degree of motion in the joints, and cannot be so easily effected. It is recommended to saw the radius and the ulna together, so as to finish upon the latter, because, in being connected more firmly to the humerus, the ulna gives a better support to the action of the saw. In advising the operator to place himself in front between the limb and the trunk, I have not intended to establish a general rule. Garengeot positively advises the contrary; and Bertrandi adds, that in case the patient is in bed, the operator would be improperly situated, at least on the right, if he did not place himself on the outside. The English and German surgeons, Mr. Guthrie amongst others, are wrong in saying, that amputation by flaps is only applicable to the superior part of the fore-arm; it is applicable to any point of its length. Le Dran remarks that a subject upon whom he operated in this manner,

was cured in twenty days, whilst by the circular method he did not obtain cicatrization until the expiration of two or three months; but there is nothing astonishing in this, since they did not in his time attempt union by first intention after circular amputation.

Art. 5.—The Elbow.

History and Appreciation.—Some surgeons of the last century, founding their opinions upon a passage of Pare, who says that he had ventured to disarticulate a fore-arm gangrened after fracture, have thought that this operation would be of considerable advantage in practice; amongst others, that of preserving to the limb three or four inches more in length than by amputating the arm itself. Many of the moderns have objected that this advantage is one of too slight importance to be purchased at the price of such numerous difficulties and dangers of every description which accompany such a disarticulation. If it is possible to cut in the soft parts a flap long enough to cover completely the articular extremity of the humerus, circular amputation immediately before the joint must be equally practicable. In the contrary case, say these objectors, one could not decide upon leaving such a large cartilaginous surface uncovered, and the amputation of the arm becomes indispensable. These arguments are less conclusive than they at first appeared to be; even if the fleshy parts are in such a state that they can be preserved, it does not follow that the bones are sound to the point where the saw must be applied to preserve the smallest fragment. Necrosis, caries, comminutive fractures, &c. may extend themselves as far as the articulation, without the surrounding tissues losing entirely their primitive characters; the diseased bones then being once removed, who does not know that the soft parts the most deeply affected, often return at last to their natural state. Besides, the operation which is in fact less dangerous in itself than the amputation of the arm, is far from being so difficult as some have imagined. Dr. Rodgers, of New York, has practised it with success, and M. Dupuytren has found no reason to condemn it. For my own part, I believe it to be indicated in every instance where the alteration of the bone approaches within an inch or two of the articulation.

Manual.—Ambroise Pare, who was conducted by circumstances, or pressed by necessity to the performance of this operation, has not, or has at least but very vaguely described his method, supposing no doubt that every one could guess it and imitate it.

A. *Flap Method.*—1st. *Process of Brasdor.*—After several trials Brasdor came at last to the following precepts:—An incision in shape of a half-moon with its convexity downwards compressing the posterior half of the circumference of the member, is first made a few lines beneath the summit of the olecranon, so as to admit of the division of the latter ligaments and the tendon of the triceps, and to open freely into the articulation of the radius. The knife being passed flatwise from one side to the other, between the anterior face of the bones and the fleshy parts, then forms a large flap, of which the base corresponds with the joint, and the free end comes about three or four inches below. Finally the operator concludes by disarticulating the ulna in the direction from the coronoid process to the olecranon, and by the division of the triceps when it has not been effected before.

2d. *Process of M. Vacquier.*—M. Vacquier proposes to modify as follows, the process of Brasdor:—With a two-edged knife he begins by cutting the anterior flap from below upwards, as far as the articulation; cuts the ligaments which unite the radius and the ulna to the humerus; luxes the fore-arm; and closes by detaching the olecranon from the large tendon to which it gives attachment, and from the teguments, so as to leave a flap some lines in length behind.

3d. *Process of Sabatier.*—Sabatier ascribes to M. Dupuytren the suggestion that it is much better to saw off the olecranon and leave it attached, to form the flap after the manner of Faye, in amputation of the shoulder, or that of Verduin, for the amputation of the leg, than to follow to the letter the advice of M. Vacquier.

4th. *Process of M. Dupuytren.*—According to M. Sanson and Begin, M. Dupuytren has in seven or eight instances practised the amputation of the elbow with success, according to the manner of Verduin; that is to say, by plunging a two-edged knife in front of the articulation, from one condyle of the humerus to the other; between the bones, which he grazes with the knife, and the soft parts, which he holds up in the left hand, and then divides them from above downwards. The disarticulation being effected, M. Dupuytren completes the operation by sawing or removing the olecranon.

5th. *Process of the Author.*—I do not see any advantage in preserving the olecranon, as advised by Sabatier and frequently done by M. Dupuytren. The triceps has no occasion for it in order to move the humerus, and it is evident that its presence cannot favor in any degree the success of the operation. In order that the saw may act upon its anterior face, it is necessary that the articular surfaces should be completely dislocated. There can then be no difficulty in detaching it from the teguments which cover it behind. But supposing that the operator is bent on preserving it, the following modification appears to me to offer some advantages:—An anterior flap is formed after the manner of M. Dupuytren, but a little lower down than directed by that operator. The integuments which remain behind are then divided as in the circular method, at about an inch below the epicondyles. The operator then cuts the external lateral ligament and disarticulates the radius, and after having exactly incised all the soft parts which surround the ulna, he saws through it immediately beneath the coronoid process as near as possible to the joint, in the line of the humero-radial articulation. He thus avoids all the difficulties of the disarticulation of the elbow; the operation is as prompt as that by any other method; there is no occasion to exert any traction or wrenching upon the bones; and the wound, which is sensibly less, is necessarily less disposed to suppurate, and admits more easily of immediate union.

B. *Circular Method.*—I have arrived at the conviction that the circular mode of amputation here offers undeniable advantages. An inch of integuments preserved below the elbow would suffice to cover the humeral trochlea, while by the flap method three or four are required in front. As all the muscles are removed, the incision must in reality be much smaller and less exposed to profuse suppuration, and would not occasion such a lively reaction. After having divided the skin circularly, I dissect it and turn it back as far up as the joint, after which I cut the anterior muscles, then the lateral ligaments, in order to disarticulate from front to rear, and close with the division of the

triceps. The humeral artery is the only one that requires to be tied or twisted, and the ruffle of skin may be turned forwards without the least difficulty to close the wound.

Art. 6.—*The Arm.*

As the amputation of the arm is most frequently required by a disease of the humero-cubital articulation, it is generally performed below the middle of the limb. But other affections, such as injuries to the arm itself, sometimes require this operation to be performed nearer to the shoulder.

Anatomical Remarks.—The only bone which enters into the constitution of the arm is cylindrical in its centre; slightly turned upon its own axis; flattened so as to present its edges bare beneath the skin, near the elbow; and surrounded by numerous muscles. The deltoides, the coraco-brachialis, the long heads of the triceps and the biceps which are also attached to the scapula, the pectoralis major, and the latissimus dorsi, form a distinct system, the retraction of which should be expected when amputation is performed above the deltoidean muscles. As they are all inserted below the head of the humerus, M. Larrey has concluded that in amputating at the surgical neck of the bone, the fragment which is preserved can be of no avail; that it is even inconvenient, since the supra and infra spinati muscles hold it in a state of permanent extension. Below the deltoid muscle, the biceps which extends without intermediate attachment from the shoulder to the fore-arm, is the only one which can retract itself to any considerable extent, after having been cut. The others, the brachial and the three connected portions of the triceps, having their fibres attached to the humerus itself, can withdraw themselves but very slightly from the point where they have been divided by the knife.

Manual.—A. *Circular Method.*—If with Petit, after having incised and raised the skin, we content ourselves with dividing all the muscles at a single stroke on the point where the saw is to be applied in the inferior half of the arm, the biceps muscle will rarely fail by its consecutive retraction to produce the denudation of the bone. The teguments are too movable upon the aponeurosis to require that we should dissect and turn them out, as advised by Alanson. There remain for choice then, the process of Celsus or of Louis, modified by M. Dupuytren, and that of Desault.

The patient being placed and the artery compressed as for the amputation of the fore-arm, an assistant holds the limbs apart from the trunk at nearly a right angle. The rule requires that the surgeon should place himself on the outside, but when he operates on the left arm, there is some advantage to be gained by placing himself on the inside. The left hand of the surgeon is thus still enabled to draw the skin as the instrument divides it. The section of the integuments is then performed as near as possible to the elbow. In incising the muscles circularly at the edge of the retracted skin, it is very important to traverse the whole thickness of the biceps muscle. It might even be cut alone in the first instance, as is done by Mr. S. Cooper, so as not to touch those of the deep stratum, except at a few lines from the point where the section of the bone is to be made. When the humerus has been exposed, it can do no harm to separate from it the fleshy fibres parallel to its length to the extent of one or two inches, as advised by Bell, and as now practised by M. Græfe.

M. Hello contends that these deep fibres, thus preserved, are the only ones which can really apply themselves to the end of the bone. I would add the necessity of dissecting the skin, according to Alanson, if all the other tissues are to be cut perpendicularly upon the bone at a single stroke. In every way care should be taken that the radial nerve do not escape the edge of the knife. The last fleshy stratum should be divided about three inches above the incision in the skin; the retractor and the division of the bone present nothing peculiar.

The humeral artery is found between the biceps and the internal portion of the triceps muscle, closely attached to the median nerve, and between its two attending veins. Two or three branches which here merit some attention, discover their position by the blood which jets from them. Above the deltoid depression, the biceps muscle being brought nearer to its origin, cannot withdraw itself to the same extent, but as the volume of the muscles is much more considerable, it is not less indispensable here than below to preserve as much of the skin, and to favor the retraction of the muscles as much as possible before sawing the bone.

De la Faye had before advanced, and Le Blanc had already disputed the opinion defended by M. Larrey in his Memoirs of Military Surgery, that it is more advantageous to disarticulate the humerus, than to divide it above the muscles by which it is connected with the chest. But the question has been decided in favor of Le Blanc and of M. Richerand. Experience has proved that after the cure, the deltoid, the pectoralis major and latissimus dorsi, the teres major and coraco-brachialis muscles, are not without action upon this *little end of bone*, as it is termed by De la Faye, and that they can impress different motions upon the stump. The little which is left of the arm increases at least the projection of the shoulder, opposes the sliding of the clothes, preserves the hollow of the axilla, most frequently enables the subject to hold against the breast some foreign bodies, such, for instance, as a cane, a port-folio, or the like; besides it is not necessary to open the articulation, nor to fill up the large *cul-de-sac* which exists between the acromion process and the scapular tendon of the triceps muscle.

B. *Flap Method.*—The arm is the limb which appears to be the least adapted to the flap method, inasmuch as its round form, the disposition and the small size of its bone, tend greatly to the success of the circular method. Klein and M. Langenbeck have nevertheless endeavored to bring it into vogue. I have myself had recourse to it twice upon the living, and have practised and caused it to be practised many times upon the dead subject. At the first glance it seems as if the operator would be enabled to derive from it a great advantage in reference to immediate union. By it, it is not only the skin, as in the circular method, but the muscles besides that cover the extremity of the bone and close the wound. The operator has then nothing to fear from the retraction of fleshy fibres nor from the isolation of the skin: three strokes with the knife, one for each flap the other to denude the bone, and one with the saw, suffice to complete the operation. Of all these advantages, promptitude and facility are the only ones of real value. The mass of muscles to which so much consequence is attached, only favors the development of phlegmonous inflammation in the stump, tends continually to slide to one side or the other, and upon the slightest suppuration to expose the bone at one of the

angles of the wound. In no other place are the inconveniences of the flap method so manifest: but Sabatier himself recommends it when it is necessary to amputate near the shoulder.

1st. *Process of Klein.*—A narrow knife plunged through from the radial to the cubital side, grazing the bone, cuts a semilunar flap of about three inches in length. After having formed a second in the same manner on the opposite side, the operator causes the two to be held back, and incises at their base what few fibres still adhere to the bone which he saws with the ordinary precautions.

2d. *Process of M. Langenbeck.*—The assistant forcibly draws upon the integuments. The operator being on the inside, supports with the left hand if operating on the right arm, and *vice versa* if on the left arm, the inferior part of the member; with the other hand, armed with a good knife, he cuts with a blow from the skin to the bone an internal flap, which should be as in the preceding case of two or three inches in length; then passing the knife and the wrist beneath and returning them to the front of the arm, he is in a position to form an external flap similar to the first. I have seen young German surgeons practise this operation in our amphitheatres with the greatest celerity; but such trick of strength or of address, can only be valuable in the eyes of those who, like the pupils of Langenbeck and of Græfe, are for him that operates the most quickly, and who counts the seconds in amputations.

3d. *Process of Sabatier.*—Sabatier only recommends the flap method where the operation is performed too high to permit the use of the tourniquet. His process, as already described by Le Blanc, consists in making, by means of one transverse and two longitudinal incisions, a flap in the form of a trapezium, at the expense of the anterior external part of the deltoides, raising this flap, and by a circular incision cutting the rest of the soft parts before passing to the division of the bone. It will suggest itself to every one that, in this case, as in all others where amputation is performed near the shoulder, compression should be applied to the artery above the clavicle, or upon the second rib, in the manner which I will describe below.

Art. 7.—The Arm at the Joint.

It is an error to believe that, up to the commencement of the last century, no one had dared to disarticulate the arm. Laroque reports an instance of this operation in 1686—the member had fallen into gangrene: "The surgeon took a small saw to amputate the humerus, but perceiving that it wavered towards its articulation *with the shoulder*, he gave it a little jerk and the bone easily came out of its socket, after which the boy was speedily restored to his former health." Although the idea must have frequently presented itself to the minds of the surgeons, the fear of opening an articulation of such magnitude, the want of means to suspend the course of the blood in the limb during the operation, and the proximity of the trunk, had kept off the boldest practitioners. Le Dran is the first to have described it: his father had had recourse to it in a case of necrosis of the humerus, attended with profuse suppuration, and effected a complete cure. It has been since pretended that the elder Morand had performed this operation before Le Dran, but without sufficient proof. At the present day the advantages of this amputation are so

longer disputed, and it has been so often performed that it is unnecessary to discuss its possibility.

Anatomical Remarks.—The articulation of the shoulder is overtopped by two processes which pass in front of its line, and which increase in an especial manner its vertical diameter. It consequently presents a disposition much more favorable to coaptation of the amputatory wound, transversely than vertically. The head of the humerus forms a very obtuse angle with the body of that bone, and the fibrous capsule is attached a little beyond its limits. At the time of amputation, the edge of the knife must describe a circular line exactly corresponding to the plan of this head, in order to divide with ease the fibrous tissues. The glenoid cavity, crowned with a fibro-cartilaginous ridge, is itself longer in a vertical line than horizontally; and this disproportion is apparently increased by the fossa formed by the two above mentioned processes of the scapula. In proceeding downwards we find about this articulation (beneath the common integuments and a very fine aponeurotic lamina), the deltoid muscle, a loose cellular stratum, the tendons of the supra-spinatus, of the infra-spinatus, of the sub-scapularis, the teres minor, and inclosed within them the fibrous capsule and the long tendon of the biceps; to the inside, the coraco-brachialis and the short head of the biceps muscle; lower down, the scapular head of the triceps; then the brachial plexus, the axillary vessels, and under the skin the pectoralis major, and the longissimus dorsi and teres major. Several of these objects may be easily recognized from without: thus the summit of the acromion is perceived above the projection of the shoulder, and seems continuous on the inside with the clavicle; and the coracoid, a little nearer to the breast and more prominent, is also easily discovered. There too is a triangular space of which we may avail ourselves in practice. It is bounded on the outside and below by the head of the humerus, above by the clavicle and the acromion, on the thoracic side by the coracoid process. This space leads directly to the articulation, and has served as a guide to M. Lisfranc in the execution of one of his operations. The posterior border of the arm-pit being raised and turned outwards upon the scapula, permits us to arrive beneath the acromion and to traverse the outer and upper part of the articulation. The acromion is much more prominent upon some subjects than upon others; at times also its anterior border is very low, so that its humeral face presents a very deep concavity. In infancy it remains long cartilaginous. Upon two adult subjects I have been able to separate it with a slight effort, as an epiphysis of the spine of the scapula. These different anomalies being capable of rendering the disarticulation of the arm either more easy or more embarrassing, should be always present to the mind of the operator, as well as the other anatomical details which I have just given.

§ 1. *Manual.*

The amputation of the arm in the articulation is one of those which offers the greatest number of operative processes. Every surgeon who has performed it, has believed himself bound to invent a new one; they have brought into use the circular, flap, and oval methods, and all the varieties of which these several general methods would admit.

A. *Circular Method.*—The idea of applying the circular method to the dis-

articulation of the arm was not, as M. Blandin believes, suggested by the author of the article Amputation in the Encyclopedia. Garengeot expressly declares, that in his time it was preferred by many persons; Bertrandi likewise mentions and condemns it. Alanson described it in 1774; and advises that the muscles should be cut obliquely, as in the amputation of the thigh.

1st. *Old Process.*—The phrase of Garengeot implies the simple circular method. The artery being compressed upon the first rib and the fleshy parts drawn up by the assistant, the operator incises successively the integuments and the muscles as far as the bone; commencing at three fingers' breadth below the acromion. A final stroke of the knife detaches the head of the humerus from the glenoides cavity, and terminates the operation.

2d. *Process described by Bertrandi.*—A large convex bistoury divides transversely the mass of the deltoides on its dorsal face at some distance from the acromion, arrives upon the biceps muscle, opens the capsula, passes behind the head of the humerus after having dislocated it, and finishes the division of the soft parts with that of the posterior half of the limb.

3d. M. Cornuau, formerly a pupil of the military hospitals, has proposed in his thesis a process, founded upon the same principles as the preceding. The skin being divided at four fingers' breadth from the acromion, and drawn up by the assistant, the operator passes to the division of the fleshy parts, which he effects by a single stroke carried transversely from the coracobrachialis as far as the tendon of the teres major, causes them to be drawn up, opens the articulation and passes through it from above, grazes the neck of the humerus, and terminates by a second transverse incision which connects the two extremities of the first, comprehends the vessels, and completes the circular incision.

4th. *Process of Alanson and of M. Græfe.*—That of Alanson presents no peculiar feature. M. Græfe, however, in order to form a hollow cone with the base downwards at the expense of the muscles, uses the wide point of a knife terminating in the point of a shield.

5th. *Process of the Author.*—I have repeated all the varieties of the circular method upon the cadaver, and I have found that no other is more prompt, or affords an incision more regular, and more easy to unite immediately. The process which appears to me to embrace the most advantages, consists in dissecting and raising the skin, without touching the vessels, to the extent of two inches; then cutting the muscles after the manner of M. Cornuau as near as possible to the articulation, through which the knife is immediately passed, and finishes with the division of the triceps and of the vascular packet, the root of which has been previously seized by an assistant.

B. *Flap Method.*—The different processes which come under the flap method, may be arranged in two classes; from the one results a transverse wound, the other produces a wound the greater diameter of which is vertical.

1st. *Transverse Method.*—Each of these two classes forms, in some sort, a particular method, the respective advantages and inconveniences of which should be carefully appreciated. The first has been for a long time the only one employed, and includes the processes of Le Dran, Garengeot, de la Faye, M. Dupuytren, M. Lisfranc, and others.

a. Process of Le Dran.—The patient is seated on a chair; the assistant seizes the arm, and holds it moderately extended from the trunk. With a

narrow knife the surgeon incises transversely the deltoides, the two heads of the biceps a little in front of the acromion, then the tendons which attach themselves to the head of the humerus, and the fibrous capsule. Whilst the assistant sways the arm and disjoints the extremity upwards, the surgeon, keeping the knife in a transverse position, passes through the articulation, slides the instrument behind and cuts a flap of three or four inches at the expense of the fleshy parts of the posterior portion of the limb, and comprising the nervous plexus, the vessels, the borders of the axilla, and various muscles.

b. Process of Garengeot.—The mode of Garengeot differs in three points from that of Le Dran. Instead of a straight needle, he advises a curved one, which is passed from front to rear through the flesh, grazing the neck of the humerus, so as to compress the artery. He recommends to make the first incision at three fingers' breadth from the acromion, in order to form an upper flap at the expense of the deltoid. Finally, in finishing, according to Le Dran, with an axillary flap, he allows it less length and cuts it square, so that it may better fit the deltoid flap.

c. Process of La Faye.—La Faye makes no previous ligature and cuts but one flap; but instead of leaving it below he forms it above, in the form of a trapezium. A transverse incision is first made above the inferior attachment of the deltoid muscle, at about four fingers' breadth from the summit of the acromion. Two other incisions which he then commences, the one on the inside, the other on the outside of that process, are made in the direction of the fleshy fibres to meet the corresponding extremities of the first; the flap dissected and raised up, permits the opening of the articulation, the dislocation of the humerus, the exposure of the soft part of the axilla, and the ligature of the artery, before detaching the arm from the trunk.

d. Process of M. Dupuytren.—In a thesis sustained in 1803, M. Grobois advises the following modification of the process of La Faye:—With one hand the operator takes up the whole thickness of the parts which should form the superior flap; with the other he pierces them at the base of the deltoid with a small knife held horizontally, the edge of which should be directed in front; he then cuts the flap by drawing the instrument outwards and forwards, taking care to allow it a sufficient length. M. Grobois speaks of this modification as of a thing which belonged to him, and of which he had thought a long time before. But it is probable that he derived the idea from the lectures of M. Dupuytren, for it is under the name of this professor that the process is generally known.

e. Process of M. Onsenort.—Instead of being formed from the deeper parts to the skin, the deltoid flap may be cut in the opposite direction; that is, from the integuments towards the articulation, from its apex towards its base, assuming as before a semilunar form. This manner, which does not sensibly differ from that of Garengeot, is yet by some pupils attributed to M. Dupuytren. I have seen M. Dubled and Guersent, junior, practise it upon a dead body with great address, and M. Onsenort exerted himself, in 1825, to bring forward its advantages. Mr. Cline, of London, begins by compressing the artery upon the first rib; then with a narrow knife he makes, at the expense of the deltoid, a flap capable of covering the wound, passes through the articulation, and divides at a single stroke the muscles which unite the arm to the shoulder and the trunk. This process, which the surgeon of London has practised for a

long time, is described by Dr. Smith (in Dorsey's work) in a manner extremely obscure, but it very much resembles the preceding; and I can say that in practising it according to this idea, I found that the operation could easily be performed with a rapidity which it is difficult to conceive.

f. Process of M. Lisfranc and Champesme.—M. Grobois had already suggested that another advantage would be derived from his modification of the process of La Faye, by contriving to open the superior part of the articular capsule at the first stroke. M. Lisfranc and Champesme have made this remark the foundation of a new process. The arm with the elbow somewhat near the trunk, is carried in this position upwards and outwards. The operator being placed in front of the shoulder, applies the point of the knife to the triangular space which has been above described, one of the edges being directed upwards and forwards; plunges it through the soft parts and through the articulation outwards and backwards and downwards, so as to bring it out at about an inch behind the acromion; seizes the deltoides, raises it with one hand, cuts forwards and slightly upwards, turns round the superior part of the head of the humerus, and gradually brings the edge of the instrument to a direction nearly horizontal; sways the arm from the trunk about fifteen or twenty degrees as soon as he has cut about an inch, and finishes the flap as in the processes of M. Grobois and Dupuytren.

g. Bell begins by a circular incision four inches below the joint, then makes a longitudinal incision on each side so as to form two flaps after the manner of Ravaton, dissects and raises these flaps, and finishes with the disarticulation. Of all these methods, the most prompt and simple is that of Mr. Cline or Onsenort; but then it is difficult to give to the superior flap the full extent desired. That of M. Lisfranc, which follows next, would be still more prompt if in performing it unpracticed surgeons did not run the risk of striking against the head of the humerus or of the acromion with the point of the knife: there is besides a risk of forming a flap much too narrow at its base. It is evident that if we are content with one flap above, the process of Dupuytren or that of Lisfranc is preferable to the three incisions of La Faye.

2d. *Vertical Method.*—To the second class belong all those processes which aim to place the flap before or behind, or to form one in each of these situations.

a. Process of Sharp.—The first process in the list which we are now to begin is that of Sharp. This author first incises the skin, the deltoides, and the great pectoral muscle, from the summit of the acromion to the hollow of the arm-pit, in such a way as to expose the vessels and to afford an opportunity of tying them. He then passes through the articulation from within outwards, and finishes by cutting the soft parts of the opposite side, so as to preserve as much of the skin as possible.

b. The Process of Bromfield is too complicated and too long to merit a description now, although it belongs properly to the vertical method.

c. Process of Pojet.—Pojet, in a thesis upon the disarticulation of the arm, proposes to make a longitudinal incision from the summit of the acromion to the vicinity of the humeral insertion of the deltoid, to remove the lips of the incision so as to cut the articular capsula and the tendons which surround it; to lux the head of the bone, and finish by sliding the knife between it and the flesh and cutting downwards.

A process nearly analogous to this has met with complete success in the hands of Dr. Dorsey of Philadelphia.

d. Instead of belonging to the circular method, the *process described by Petit-Radel*, in the Encyclopedia, is nothing more than that of *Bell*, modified in such a manner that one of the flaps is on the inside, the other on the outside.

e. Process of Desault.—The member is held between the state of extension and that of flexion, and is directed slightly forwards. The surgeon clasps with one hand the fleshy parts of the shoulder, traverses them downwards and backwards with a narrow knife, grazing the head of the humerus; forms an internal lambeau three or four inches long, which includes the anterior side of the axilla, the vessels and the nerves, and which the assistant raises immediately, so that the operator may pass through the joint from front to rear, or from within outwards, and finish by forming a posterior or external flap similar to the first.

f. Process of M. Larrey.—In operating according to Desault, you divide the artery at the first stroke, and that may occasion serious accidents, if from any reason the amputation cannot be promptly finished. M. Larrey thought it better to begin with the posterior flap, to open the joint from the outside, and to finish with the internal flap.

g. Another process of M. Larrey.—M. Larrey, who has so often performed this disarticulation in the army, describes another process for effecting it, to which he ascribes great advantages. He cuts at first through the whole thickness of the cushion of the shoulder, in the direction of the fibres of the deltoid, and to the extent of four inches, as in the process of Pojet. He causes an assistant to draw asunder the lips of this incision, to the upper end of which he again applies his knife, and pushes it through from above downwards, so as to make it emerge in front of the posterior edge of the axilla, and cuts from this beginning the posterior flap. He comes back to the same point as at first, and cuts in the same way an anterior flap; leaving between the two the soft parts which fill up the cavity of the axilla, so as to save as yet the artery and the nervous plexus. He then divides the deep seated tendons and the capsule; passes through the articulation, glides the knife behind the head and neck of the humerus, and finishes by dividing the pedicle between the basis of the flaps. Hence results a wound of nearly an oval shape.

h. Process of M. Dupuytren.—M. Dupuytren forms the posterior flap by cutting from the surface inwards, from its apex to its base, and then completes the operation in the same way as M. Larrey.

i. Process of M. Delpech.—If you neglect to form a posterior flap, or give it but little length; if you fall almost immediately upon the external face of the articulation to open it, pass through it, and finish by forming a large internal flap, you have the process of M. Delpech.

j. M. Hello first cuts a superior flap, like M. Dupuytren, and then carries the knife between the shoulder and the chest, to finish the operation upon the principles of the circular method.

This process, says he, which was followed by M. Fouilloy, is particularly applicable where the humerus is broken up, or when displaced fragments of bone render the formation of any kind of flap by puncture more difficult than usual.

k. Process of M. Lisfranc.—To avoid the reproach cast upon his first process without sacrificing its advantages, M. Lisfranc has the arm moderately extended from the trunk; places himself on the outside; applies the point of a long knife in front of the posterior border of the axilla, as if to raise this border and push it back; passes through the whole thickness of the soft parts, and through the articulation upwards and forwards, bringing out the point very near the anterior edge of the acromion, between that process and the carocoid; begins to cut outwards; raises the arm a little, and inclines it a little backwards; turns with the blade round the posterior and superior half of the head of the humerus, and cuts from there his posterior flap; returns to the joint, and finishes like M. Dupuytren or M. Delpech.

C. *Oval Method.*—It would be easy to discover the origin of the oval method in the processes of Sharp, Pojet, Bromfield and Larrey. At all events, it does not belong to Beclard, to whom it is ascribed in this country, nor to Guthrie, who was the first to describe it in England. I have seen it distinctly announced in several theses of the school of Strasburg, particularly in that of M. Blandin, defended in 1803, and still more clearly in that of M. Chasley, who even uses the word *ovalaire* to designate the form of the wound. The several processes which it admits differs but little from each other.—*Mr. Guthrie* forms a V, by means of two incisions extending from the acromion to the opposite sides of the axilla close to the chest; cutting the skin first and the flesh afterwards. *Beclard* and *M. Dupuytren* cut at once to the bone, but in both processes the incision should be somewhat convex forwards, and quite superficial below, to save the vessels until after the disarticulation. Preparatory to this is the detachment of the point of the V by a third stroke. The base is cut off by the last stroke. *M. Scoutetten* varies from this process only in bringing the internal incision to the edge of the axilla, and with a continuous motion carrying it across that space and up on the outside to the point of departure, taking care in passing the axilla to cut only the skin.

Process adopted by the Author.—First Stage.—As the muscular fibres are cut near their origin, and their retraction cannot be considerable, it is right to imitate Mr. Guthrie in first cutting the skin alone, and causing it to be drawn back if the shoulder is covered with much flesh, otherwise it is well enough to cut at once to the bone. *Second Stage.*—The point of delicacy in the oval method is the opening of the capsule; if the bistoury penetrates too deeply, the fibrous pouch yields and folds itself like a wet cloth, and is mashed rather than cut: if it fall without the surgical neck of the bone, the ligamentous connexions are but imperfectly destroyed. To obviate this difficulty, the surgeon, while the lips of the wound are held apart, should seize the arm with one hand and make the head of the bone project, turning it inwards at the same time on its axis; carry a sharp bistoury flatwise between it and the flesh, and then turn its edge at right angles upon the capsule at the level of the surgical neck of the bone, and then cut with the full edge all the tendons, beginning with the teres minor and ending with the subscapularis, taking care to let nothing escape; to take the head of the bone for the support of the incision, and to roll it on its axis in one direction as the instrument is drawn on the other. In this way the articulation is freely opened and the arm is easily dislocated, permitting the division of the rest of the capsule by the bistoury carried in front, behind, and within, as if to shave the bone. In the *third stage*, the

assistant, behind the shoulder, puts his thumb upon the artery in front of the glenoid cavity, and compresses it in the mass of flesh left between the lower extremities of the incisions already made; while with a small knife, or even with the same bistoury which has served him thus far, the surgeon cuts through the base of the V, and completes the separation of the member from the trunk.

§ 2. *Comparison of the different Methods.*

In all these processes it is necessary to suspend for a time the course of blood. Of the various modes of effecting this, that of Le Dran or Garengeot is uncertain; that of La Faye and others almost necessarily includes in the ligature parts which should be avoided; that of Sharp increases the sufferings of the patient and the length of the operation. The compression upon the first rib is not always applicable, and if imperfectly applied, endangers fatal hemorrhage. A method more sure and simple is to divide last of all the parts which contain the vessels. The preparatory ligature of the subclavian, which has been performed by Dr. A. H. Stevens, in 1821, cannot be required except by very considerable deformity. I do not know who first proposed the mode which I have recommended; but it was not until within twenty years that it was, upon the recommendation of M. Richerand, generally adopted. The other arteries which it is sometimes useful to tie, are the acromial, the external thoracics, the circumflexes, and some branches of the subscapularis. These are not commonly tied until after the axillary, but if they bleed profusely, or if anything prevents the immediate completion of the operation, they may be easily tied as fast as they are divided.

In so many different processes, there is no one which merits an exclusive preference; no one that will not arrive at the end proposed; nor any which has not its peculiar cases to which it is better adapted than any other. The choice should be decided by the circumstances of the disease; such as its proximity to the joint; its greater advances on this or that side, or above or below; the degree of motion it allows to the joint, or the position in which it arrests the limbs. But it is at the bedside that the skillful surgeon should appreciate these various exigencies.

But then supposing that nothing in the state of the parts obliges us to conform to any one mode rather than another, what method presents the greatest advantages? Those which leave a transverse wound leave also too great a cavity between the acromion and the inferior border of the glenoid cavity. The celerity of M. Lisfranc's second method leaves nothing to be desired in that respect. That of Desault, modified by MM. Larrey and Dupuytren, requires but little more time; but the oval method, as furnishing a wound incomparably more regular, although it requires more skill and more precise anatomical knowledge, is yet I think to be preferred. With practice it becomes easy, and I have seen Doctor Chomet, of Bordeaux, complete it in thirty seconds upon the dead subject. I know none but the circular method of Cornuau or my own, which surpasses it, and can be substituted for it with advantage.

Art. 8.—*Shoulder.*

History and Indications.—Four patients have been mentioned by Cheselden, Carmichael, Dorsey, and Mussey, who had the whole shoulder torn away, and yet finally recovered. In the army M. Larrey several times took away with the arm a large part of the scapula or of the clavicle, and success more than once rewarded his boldness. M. Clot and Mr. Brice removed with the arm a portion of the scapula, and Mr. Cuming, at Antigua, the whole, and all three with success. The amputation of the shoulder may become necessary for the preservation of the arm. Janson has published one instance, M. Beauchene operated in another, and Mr. Lucke in a third.

Sometimes this operation is required by a necrosis, a caries, or a comminutive fracture, with a disorganization more or less extensive of the soft parts, when a simple disarticulation will not completely remove the disease. Sometimes a tumor, formed of abnormal tissues, which comprehends a part of the arm and extends beyond the joints. Sometimes the tumor or morbid change of structure occupies only the scapula and the tissues about it, so that the arm may still be preserved.

Manual.—In the *first case* the diseased bones are to be exposed as far as the limits of the disease. The flaps are formed and managed as in amputation at the joint, and cut in this or that direction, according to the state of the parts. If it is impossible to avoid the artery, it should be compressed on the first rib or previously tied. The saw commonly used for dividing small bones, or chain-saw of Jeffreys, may then be applied, to cut off such portions of the scapula or clavicle as may require removal. In the *other two cases* it would be difficult to lay down any precise general directions. The surgeon must rely upon his own resources of knowledge and invention.

SECTION II.

Inferior Extremity.

Upon the inferior extremity the amputations are generally more difficult and more serious than upon the thoracic member. They will be treated here as they are performed upon the foot, the leg, the thigh, in the continuity, and in the contiguity.

Art. 1.—*The Toes.*

It is not with the toes as it is with the fingers. The uses to which the latter are applied render their preservation more important, and their length admits of partial amputation. But the former, having an insignificant office to perform, and possessing but slight extent, may be taken away all together without affecting essentially the functions of the foot. For a similar reason we scarcely ever amputate one or two phalanges of the toes, nor a part of the metatarsal phalanx, except perhaps, sometimes that of the great toe.

The processes to be followed being exactly similar to those prescribed for the amputation of the fingers, need not be here repeated. I will only remark,

that the natural cavity which corresponds to the dorsal face of the metatarso-phalangeal articulation, and the projection which forms the sole of the foot, render the amputation of the toes severally more difficult than that of the fingers, and that the oval method is still more advantageous to the appendices of the foot than to those of the hand. The amputation of two or three, or of all the toes together, should be performed as on the fingers, in the way recommended by M. Lisfranc. It is neither more complicated nor more difficult, and there is the same chance of success. But there are few injuries so severe as to comprehend all the toes, without affecting at the same time more or less of the metatarsus; yet some examples, the result of frost-bite for instance, have been recorded. I have seen in *La Pitie* an invalid who had been treated in this manner nearly forty years before, by La Chapelle. M. Chaumet has recently published an instance of the same thing.

Art. 2.—Metatarsus.

The metatarsal bones, like those of the metacarpus, are amputated either in the continuity, in the contiguity, separately, or collectively. They may also be extracted, leaving the corresponding toe.

§ 1. *In the Continuity.*

The amputation of the three middle metatarsal bones in continuity, is practised frequently, and always by the same rules, as for the amputation of the corresponding metacarpal bones. Some surgeons think that it ought to be preferred to the simple disarticulation of the toes. Mr. Thomas for example, maintained, in 1814, that it is less difficult and less dangerous, and that the deformity which results from it is less obvious. This is evidently an error. To remove a metatarsal bone, it is necessary to divide at two different strokes the thickness of the soft parts of the sole of the foot, disturb some of the tarso-metatarsal articulations, and produce a very extensive wound; while the amputation of the toe is finished in an instant, and leaves a solution of continuity, very simple and easy to heal. Thus in the foot as in the hand, and for the same reason, the metatarsal bone must not be touched, unless it is impossible to remove the disease by amputating only the toe.

First Metatarsal Bone.—The first metatarsal bone is an exception to this rule. From the time of Le Dran to this day, most surgeons have preferred dividing it behind its head to separating it at the joint. Dislocating the toe they say, gives birth to a shocking deformity; the anterior extremity of the bones forms a considerable projection, which rubs painfully against the shoe, and only impedes, instead of aiding the functions of the foot. It is true that the deformity is less evident after the amputation of the metatarsal bone, than after the simple removal of the toe. But it is undeniable also that the standing posture is more difficult to maintain, and less secure in the former cases than in the latter. In this point of view then, the simple amputation of the great toe is to be preferred. Other practitioners, and among them M. Gouraud, are of opinion that it is better to disarticulate the first metatarsal bone than to saw through it. Le Dran has already pointed out the disadvantages of this method, in endeavoring to give pre-eminence to the other, which is since generally adopted.

M. Richerand advised to cut the bone obliquely instead of transversely across. After the disarticulation, the base of the sore presents a great L, the horizontal branch of which, formed by the cuneiform bone, produces a troublesome projection on the internal side of the foot. The operation is besides less easy, and the wound more difficult to unite by the first intention. Amputation in the continuity leaves no projection on the internal side of the bone, when care has been taken to carry the saw obliquely from behind forwards. It does not require the removal of so great a quantity of the parts, nor the disturbance of any joint. I think it ought to be preferred whenever the disease does not compel us to carry the instrument up to the tarsus. Three different cases have convinced me of the justness of these rules.

Manual.—As it is difficult to draw the soft parts inwards from the sole of the foot, and thrust the bistoury downwards between the bone and the flesh; and as it is nearly impossible, especially in doing this, to preserve to the flap the regularity, breadth, and length desirable; I prefer making the incision from without inwards, and tracing its extent and form by dividing the skin from behind forwards, first on the dorsal and then on the plantar face, to near the anterior extremity of the first phalanx of the great toe, and then raising this flap and dissecting it back from its apex to its base. This done, the knife penetrates the first interosseal space, pressing outwards with its point the adherent lip of the first incision; grazes the peroneal face of the bone, and inclines a little internally to avoid the corresponding lip of the incision on the sole of the foot, which the operator at the same time draws as much as possible out of its way. The tissues are then divided with a full stroke of the knife, which is brought out at the commissure of the first two toes. Carried immediately back, it divides all the parts above and below, within and without, that may yet adhere to the metatarsal bone. A splint of wood or pasteboard, or even a simple compress thickly folded, placed in the bottom of the second wound, protects the flesh against the action of the saw. The operator seizes with the left hand the toe and the articular head which he intends to remove, causes the foot to be held outwards, applies his thumb nail to the place where the division is to commence, and then with his right hand armed with a small saw, he cuts the bone very obliquely from its internal or tibial to its external side, and from behind forwards. A dorsal or interosseal artery of the metatarsus and one or two branches of the plantar arteries, sometimes, but not always require the ligature. The flap is brought back on the wound, and exactly applied and secured by strips of adhesive plaster and a convenient bandage.

B. *Fifth Metatarsal Bone.*—The last bone of the metatarsus may be amputated like the rest, in its continuity; but the projection which it forms behind, the inutility of what might be preserved, and the facility with which it is disarticulated, together with the slight deformity which results from this operation, gives to amputation in the contiguity a general preference. This amputation is not to be performed like the preceding. The oval method is more suitable. But if you do not wish to try that, it will be necessary to pass through the last interosseal space backwards, with the bistoury held vertically from the commissure of the fourth and fifth toes to the anterior surface of the oscuboides; then to disarticulate the bone, pass from its dorsal to its plantar surface, disengage its head, and cut a flap from the soft parts of the external side of the foot, long and wide enough to cover the entire surface of the wound.

C. *Extraction.*—The extraction of the middle bones of the metatarsus would be performed as in the hand, if it could be of any advantage. The same may be said of the *fifth.* The preservation of a corresponding toe is of too little importance to compensate for the difficulties of such an operation. M. Blandin, who has lately endeavored to show that it is otherwise with the first toe, says, that after amputation, properly so called, either in the continuity or in the contiguity, the foot will be continually turning upon its inner side; and quoting an instance, which appears to confirm his opinion, asks whether the amputation of all the metatarsal bones be not preferable to amputating alone the bone which supports the great toe. Will the simple extraction, as he believes, prevent these inconveniences? The transverse metatarsal ligament preserves some firmness in the position of the great toe, after the extraction of the bone which naturally supports it. The sole of the foot maintains its breadth in front, and station and progression suffer very little from such an operation, which M. Barbier contrived in 1795. Not being able to reduce the luxation of the first metatarsal bone, this surgeon undertook to dislocate it and remove it, preserving the great toe. M. Beaufils, who published this fact in 1797, said the patient was completely restored at the end of forty days. It seems to me, however, that there is a mistake upon this subject; that after the extraction of the first metatarsal bone the deformity would be greater than after its amputation, and that the toe would be liable to turn inwards, to change its position, and to interfere with the motions of the foot. On the other hand, it is not proper to affirm that the ordinary amputation is generally followed by the inversion of the foot. It is an accident indeed that may happen, but more frequently does not. This proposition is supported by a crowd of facts. I was presented with a new proof of it in 1829, at the hospital *St. Antoine.* I amputated after the common method and the patient soon recovered. I saw him frequently afterwards; he walked continually, and did not even take the trouble to thicken the sole of his shoe on the inside. I have since seen two more examples at *La Pitie.* Before affirming, therefore, that the extraction of the first metatarsal bone should be preferred to its amputation, it is prudent to wait for further facts. This operation has been indicated by Hey, of Leeds. "When the caries is confined to the metatarsal bone of the great toe," says this practitioner, "it is customary, after having made a longitudinal and transverse incision, to remove the diseased portion with the saw. But as it is sometimes difficult to ascertain exactly the extent of the caries, it is better to separate the whole of the bone at its junction with the cuneiforme." If the extraction of the metacarpal bones has received general approbation, it is because it preserves the fingers, and affects but little the form and valuable uses of the hand, while neither the same advantages nor the same results are to be expected from a similar operation on the foot. The method of operating would be the same, unless some complication should force us to imitate M. Barbier.

D. *All the Metatarsal Bones.*—Though it was usual with surgeons up to the time of Chopart, to amputate the leg for diseases which did not involve the whole foot, they yet sometimes confined themselves to a partial amputation of the foot, which it is now the rule to amputate as near the toes as possible.

According to F. de Hilden, de Verdue, &c., the partial amputation of the metatarsus could not have been unknown to the ancients, who performed it

with the chisel and mallet, or else with the machine of Botal, and no doubt only in the continuity. Sharp has proposed that a little saw should be used, and asserts that he has seen it once executed with success. Hey proposed it anew towards the end of the last century, and alleged that in the case of a young woman, he had removed the first four toes with a great part of the corresponding metatarsal bones, but complained of the length of time it took the wound to heal. M. Lisfranc also has advised that the operation should be performed particularly on young persons, because in infancy the bistoury may take the place of the saw. M. Raoul in 1803, and Mr. Thomas in 1814, again brought forwards this proposition in their theses, supporting it, I think, on very good reasons. M. Pezerat has once practised it with success. I do not see indeed why the transverse section of the metatarsus should not be performed, rather than its dislocation, when the disease permits it.

Manual.—A small knife thrust through from one side to the other, grazing the plantar face of the bones, cuts a flap of the proper length from the soft parts of the sole. By a semicircular incision inclined a little forward, the skin on the dorsal face is next divided, and then the tendons, some lines in advance of the point where the saw is to be applied. The flesh being drawn back by an assistant, the surgeon successively denudes the bones with the bistoury at the base of the flap, so as to render easier the simultaneous or successive division from one side to the other, or from the back of the foot to its sole, M. Pezerat's process is to make three flaps, a dorsal, a plantar, and an internal one. This should never be followed, unless the pathological state renders the former process inapplicable.

In Contiguity.

Historical.—In cases where the state of the foot does not permit the sawing of the metatarsal bones, or the surgeon does not wish to resort to this operation, it is possible to dislocate them and preserve the tarsus, with the action of certain very important muscles. Garengeot says, "this amputation is very troublesome, since it has to do with a number of junctions which are not in the same line. To conduct the bistoury between the metatarsal bones, &c., cut the ligaments which unite them, and save as much of the skin as possible, is all the direction that can be given." Le Blanc is still more laconic. "One can, in certain cases, amputate a part of the foot, saw the metatarsal bones, and even separate them at their articulation, as several practitioners have alleged." It is the same with Brasdor. According to Mr. S. Cooper, it was practised in England by Turner, in 1787. Percy performed the same operation with a great deal of trouble, on a monk of Elairvaux, in 1789. It is described in the thesis of M. C. Petit (1802). M. Berchu attempted it with success, in 1814. M. J. B. J. A. Blandin, who frequently practised it in the army, gives the following directions: "Carrying the knife behind," he says, "I cut the skin and the tendons on the back of the foot, holding the edge of the knife backwards, and making it glide on the body of the bones back to the place of their articulation, so as to preserve a small dorsal flap; then I divide all the ligaments; afterwards, with the point of the instrument conducted just below the tarsus through the articulation, I cut the connexions and amputate the whole at a single stroke by a transverse section, preserving as

above a little of the sole of the foot, to form a second flap." The directions in M. Plantade's thesis (1805) were very nearly the same. But it was necessary that M. Villerme, and more particularly M. Lisfranc, should make it the subject of an especial work, which they presented to the institute in 1815, to draw to the disarticulation of the metatarsal bones all the attention it deserves. In merely saying the amputation is difficult, we only deter from its execution. There was lacking an explication of the difficulties and of the means of obviating them, and this deficiency has been happily supplied by M. Lisfranc.

Anatomical Remarks.—The three cuneiform bones united, present in front a kind of mortise moderately open, which is exactly filled by the posterior extremity of the second metatarsal bone. The interior wall of this cavity, formed by the first cuneiform, is about four lines in length and an inch high, while the external wall which is formed by the last, is only two lines in extent from before backwards. The articulation of the first metatarsal bone, which is consequently two or three lines before that of the third, is less narrow than any of the others; its surfaces are so disposed, that that of the tarsus are a little convex to suit the slight concavity of the other, and that they present a doubly oblique plane, first outwards, in the direction of a line which would fall near the middle of the metatarsal bone of the little toe, and secondly, downwards and forwards. The articulation of the middle metatarsal bone, placed transversely like that of the second, is two lines in front of the bottom of the mortise above described.

The interline of the fifth is oblique inwards, in a line which would fall upon the middle of the first metatarsal bone, whilst the fourth is nearly transverse at its external part, but inclines forwards like the preceding from where it tends to join the third, one or two lines behind which it is commonly found. As the second metatarsal bone is cased between the bones of the tarsus, so it is seldom that the third cuneiform is not wedged likewise in a kind of mortise one or two lines deep, which is formed by the third metatarsal bone in front, joined on either side with the second and the fourth. If the first cavity did not exist, the second would also be wanting. Indeed, if the third cuneiform bone lay in the same plane as the second (which scarcely projects in front of the cuboidal facet of the fourth metatarsal bone), the articulation throughout would be perfectly regular. In fact, this disposition is met with sometimes, and then the amputation is generally very easy. But frequently too, this bone projects so far as to be nearly on a line with the first cuneo-metatarsal articulation. In this case, the two mortises are equally difficult to disunite. Other anomalies frequently occur. I have seen, for example, the anterior internal face of the cuboides, pass half a line or even a whole line beyond the metatarsal face of the third cuneiform bone.

On another subject, the two last metatarsal bones united, presented a ridge of which the crest placed vertically was buried three lines deep in the front part of the cuboides, and this in both feet of the same cadaver. At another time, I found the dorsal edge of the extremity of the third metatarsal bone inclined obliquely backwards to the extent of a line and a half, upon the corresponding cuneiform bone. Messrs. Lisfranc and Zeigler have remarked that the tubercle of the fifth metatarsal bone is sometimes prolonged to a line with calcanear articulation, and I have noticed a tubercle in the form of exostosis on the dorsal face of the second cuneo-metatarsal articulation, on per-

sons who are in the habit of wearing tight boots. Lastly, many of these joints may have suffered anchylosis.

There is no necessity for a description of the dorsal ligaments that connect the tarsus with the metatarsus, either antero-posterior or transverse, as they are mere fibrous bands fixed under the tendons, without penetrating between the articular surfaces. It is not exactly the same with the plantar surface. There almost all the bones terminate in a kind of point or flattened crest, which by permitting them to incline towards each other, determines the transverse concavity of the foot, and leave between them small triangular spaces, filled with fibrous masses. One of these masses, that which unites the external face of the anterior prominence of the first cuneiform to the internal surface of the second metatarsal bone, requires great attention. Besides being very thick and strong, and formed of fibres oblique in the direction of the first tarso-metatarsal articulation, it is especially remarkable from its vertical extent bounded by that of the articulation itself. There is nothing important to notice respecting the others.

The tarso-metatarsal articulation, viewed as a whole, presents a line slightly convex forwards, the extremities of which nearly correspond to the middle of the space between the malleolus and the base of the toes. On the outside it is indicated by the posterior extremity of the tubercle, which the last metatarsal bone presents under the skin. It is also very easily discovered in the inside, by observing that under the tegument and near the sole of the foot, the first cuneiform and the first metatarsal bone have each a prominence, leaving a depression between them which marks the beginning of the articulation. A line transversely drawn from its external extremity to the internal side of the tarsus, falls a little in front of the scaphoides, about three quarters of an inch from the internal tarso-metatarsal articulation. Consequently, there can be very little difficulty in knowing its situation and direction before beginning the operation. As the tendon of the peroneus longus, in passing to its attachment to the inferior or plantar tubercle of the posterior extremity of the first metatarsal bone, generally contracts some adhesions with the third cuneiform bone, the simple disarticulation of the metatarsal bones does not necessarily destroy the action of that muscle. It is the same with the anterior peronei muscles which are inserted, at least in part, into the dorsal face of the cuboides; and with the anterior and posterior tibial muscles, the attachment of which is not severed by the operation.

Manual.—The disarticulation of the metatarsal bones is certainly the most difficult that can be met with. The usual directions are to make use of the bistoury and saw at the same time.

A. *Process of Hey.*—In 1799, Mr. Hey performed the following operation on a young girl of eighteen:—He made a transverse incision about half an inch to the front of the articulations, and another on each side, from the corresponding extremity of the first to the roots of the first and fifth toe. He then detached all the soft parts of the sole of the foot, and turned them back, to form a flap. After having disarticulated the last four metatarsal bones, he determined to remove the projection of the first cuneiform with the saw: the patient was perfectly restored. This process, may no doubt, be imitated; but it is evident that the lateral incisions, and the precaution of forming a plantar flap before disarticulating the bones, renders the operation longer and more

difficult. In saying that the last four metatarsal bones are found on the same line, Hey seems to me to mean that the posterior facet of one projects but little beyond that of the other, and not, as he has been made to say, that they form a complete transverse line. As to the section of the first cuneiform, I do not think it merits the reproach that is of late attached to it. Beclard, M. Scoutetten, and even M. Lisfranc, have practiced it without any disadvantageous result.

B. *Process of M. J. Cloquet.*—After the soft parts of the dorsal face of the foot have been divided, M. J. Cloquet prefers sawing the bones transversely instead of stopping to disarticulate them. I do not see why it would be more dangerous than the simple disarticulation. *A priori* it even seems that it would be less frequently followed by serious accidents. The tearing, rather than cutting of the ligamentous or fibrous tissues, which some persons dread, seems to threaten less inconvenience than the wrenching which is inflicted upon the articulation of the tarsus, in separating from it the metatarsus with the knife. It is yet a question whether the surface of the sawn bones is as well adapted as the cartilaginous surface, for the immediate union of the wound. This advice appears to have been given by M. J. Cloquet only for the use of those who have not been able to become sufficiently familiar with the tarso-metatarsal disarticulation.

C. *Process of M. Lisfranc.*—I do not here notice the process of M. Villerme, since he was himself the first to speak in decided preference of that of M. Lisfranc.

First Stage.—During the whole of this operation a narrow firm knife is used. A good bistoury nevertheless may serve until the plantar flap is to be cut. If the surgeon is ambidexter, the rule is to begin always with the external side of the foot, consequently carrying the knife with the right hand for the right member, and with the left hand for the left; otherwise, he commences in this last case on the internal side of the metatarsus. The patient is placed on a table, or on a bed properly pillowed. An assistant, holding the lower part of the leg, compresses the posterior tibial artery behind the internal malleolus and the anterior tibial on the instep, at the same time that he draws back the skin from this latter part. The surgeon ascertains first, by sliding his forefinger backwards along the dorsal and external side of the fifth metatarsal bone and of the internal and plantar face of the first, the two extremities of the articular line; he fixes the thumb and index finger of one hand on the tubercle of each of these bones, embracing the end of the foot underneath, according to some, or on its dorsal face according to others, and as I prefer it myself, in order to act with more ease on all the metatarsal bones. With the other hand armed with a knife he makes a semicircular incision convex forwards, the extremities of which should fall upon the two tubercles indicated by the fingers, and which divides or should divide only the skin and subjacent cellular membrane. The teguments being drawn back the instrument is reapplied in the first incision, in order to divide the extensor tendons and other soft parts which may remain over the bones at the edge of the retracted skin, and so that this second incision may correspond to the articular line. It is important in arriving at the side of the foot, to be careful not to descend too low towards its plantar surface, for fear that in ending the operation the base of the flap should be curtailed of its necessary breadth.

Second Stage.—If the cuboido-metatarsal articulation have not been opened with the stroke which divided the tendons, it may be penetrated by carrying the point of the knife behind the tubercle of the fifth metatarsal bone, in the direction of a line which would fall obliquely in front, first on the head, then on the middle part, then on the posterior extremity of the first metatarsal bone, being placed almost transversely, on arriving at the fourth, inclined again in front on entering the articulation of the third, which is separated by carrying the knife transversely. The second metatarsal bone generally prevents the knife from penetrating any further in that direction. It is then withdrawn, and applied with the point upwards to the inside of the foot, so as to pass obliquely inwards and forwards through the articulation of the first metatarsal bone. The surgeon then places the knife perpendicularly, with the point downwards and the edge turned backwards, or on the internal side of the before-mentioned mortise; he thrusts it towards the sole of the foot at the angle made by the osseous faces; then pressing on the handle, so as to sway it back and forth, divides the thick ligament, called by M. Lisfranc *the key of the articulation*, draws it out again to seek the posterior articulation of the second metatarsal bone. For this purpose he places the point horizontally across the superficial face of this bone, and as the articulation is never more than three lines behind, it is easy to open into it by cutting at every half line from the middle articulation, which is already exposed, until it is found.

After this has been done, all the osseous surfaces separate, and the point of the knife sliding among them easily divides the rest of the ligaments.

Third Part.—Nothing more is to be done, except to form a flap by grazing the plantar face of the bones as far as the metatarso-phalangeal articulations. This flap should not end square but obliquely, and should be slightly rounded at its *digital* extremity and not transverse, in order to correspond to the semicircular curve of the dorsal side of the stump. To avoid leaving the internal side of the flap thinner than the external, care must be taken in cutting it to keep the handle of the instrument more elevated than the point; and in order that the phalangeal head of the metatarsal bones, especially the first, should not arrest the blade of the instrument, it is important to incline the edge decidedly and in good time towards the skin.

Dressing.—The arteries divided are the plantar, internal and external, the anterior tibial, and some other secondary branches of little importance. The principal flap when applied against the articular surface, ought to cover it exactly, and to fit with its edge the small flap preserved on the dorsum of the foot. If in this last direction the teguments had been divided to a level with the articulations, the bones of the tarsus would be found naked immediately afterwards. As the tendons retract less than the skin, if they were to be separated at the same stroke, their ends would remain free between the sides of the wound and obstruct its reunion. It would be better in this case to cut them again with the scissors. In order to maintain more firmly the coaptation of the parts, the adhesive straps should be stretched from the posterior internal and inferior surface of the heel, to the wound, then along the back of the foot, around the lower part of the leg, or at least as far as the parts about the malleolus. The patient should be placed on his bed, so that the leg and foot on which the operation has been performed may be turned on their external side, and as completely relaxed as possible. Here, more particularly than after

any other amputation of the extremities, regular and uniform compression applied from the limits of the third part of the leg down to the wound, will be the best means to prevent the development of inflammation, synovial, venous, or of any other kind.

D. *Process of M. Maingault.*—The method of M. Maingault in this case is exactly analogous to that which he proposed for the disarticulation of the metacarpus. Though practicable, it appears to me to be in all respects less advantageous, and more difficult than the preceding, and consequently to be useful only in cases where that is impracticable.

Art. 3.—*Amputation of a part of the Tarsus.*

The three cuneiform bones, the cuboides, the scaphoides, are generally removed at the same time. Nevertheless, if the cuboides alone is affected, with the two metatarsal bones which it supports, we may, like Hey, remove only the external third of the foot. Unless there is an absolute necessity, the whole of the metatarsus should not be amputated in the articulation. The operation should be limited to the disarticulation of the diseased bones. The fourth and fifth metatarsal bones, for example, may be amputated by themselves with as much facility as the corresponding metacarpal bones; it is the same with the first two. Some observations published by M. Miarault, in 1824, and collected during the attendance of Beclard, at *La Pitie*, showing the justness of these assertions, have fully confirmed what experiments made on the dead subject had already rendered probable.

The amputation between the os-calcis and the astragalus on one part, and the scaphoides and the cuboides on the other, is, like that of the metatarsus, an operation of which no trace is found among the ancients; and which would have belonged entirely to France if F. de Hilden had not pointed it out with sufficient clearness, since M. Chopart was the first that positively described it; and the operation has since been improved only in France.

Anatomical Remarks.—The articulation traversed by Chopart, is much less complicated and less difficult to disunite than the preceding. The four osseous surfaces of which it consists possess some mobility, and are far from being so closely connected as those of the tarso-metatarsal articulation. The rounded head of the astragalus is retained in the cavity of the scaphoides only by some loose fibro-cellular bands. Outside, and on the dorsal face, it has the same kind of attachments to the calcaneum and the cuboides. The strongest and most important ligament of this articulation is that which goes deeply from the os-calcis to the peroneal extremity of the scaphoides, and which may also be called the *key of the articulation.* The articular line is divided here into two very distinct portions. Its internal half represents a half-moon, regularly convex forwards. Its external or calcanear half presents, on the contrary, a plane, oblique outwards and forwards, in such a manner that in connexion with the other it forms quite a deep sinus, that seems continuous with the dorsal excavation of the os-calcis, and into which it is easy to stray at the time of the operation, if its disposition is not exactly remembered. Like that of the metatarsus, the articulation of the bones of the tarsus among themselves is very concave and unequal on its plantar aspect, where the scaphoides and the cuboides present a projection which ought not to be forgotten

in the separation of the soft parts from those bones. Its internal extremity is marked by a slight depression, which is bounded behind by the tuberosity of the calcaneum, and in front by the corresponding tubercle of the scaphoides, which last projection prevents any groping for the articulation of the astragalus and naviculare. On the dorsum of the foot the articulation in question is indicated by a slightly depressed line, which may be felt with the finger in front of the head of the astragalus. The tendon of the tibialis posticus is attached to the internal and inferior tubercle of the scaphoides, and the tibialis anticus to the first cuneiform bone.

As the tendon of the peroneus longus passes under the cuboides, the removal of the last five bones of the tarsus necessarily destroys the attachments of these three muscles, while the disarticulation of the metatarsus permits us to preserve them. Some anomalies may change the value of these data. Sometimes the tuberosity of the scaphoides is scarcely appreciable. In other cases, there may be in the passage of the tendon of the tibialis posticus a sesamoid bone, which will in a great measure fill up the articular depression. M. Prichon has been remarked that the calcaneo-scaphoid ligament, or the *articular key*, mentioned above, is sometimes transformed into a cartilaginous epiphyses, and afterwards become completely osseous, even on very young persons. He has met this frequently, and subjected one example of it to the inspection of the professors of the faculty in defending his thesis.

We may conceive the difficulties which such an anomaly throws in the way of the operator. It was this, no doubt, that produced the anchylosis which Sir A. Cooper was obliged to break in order to finish a partial amputation of the foot; and that mentioned by M. Ficher, and which would have yielded only to the saw, if it had been necessary to amputate during life. M. Plichon remarked, and very justly, that the head of the astragalus projects beyond the plane of the anterior face of the calcaneum, more in some cases than in others; and that the calcaneo-cuboidal articulation is then less oblique forwards.

Operation.—The modes of disarticulating the scaphoides and the cuboides, can vary only in the most unimportant details. Chopart, who was not guided by the present anatomical data, thought it very difficult. It is true, that in 1779, a celebrated surgeon of Paris was nearly three quarters of an hour in completing it, though he had before his eyes at the time the foot of an articulated skeleton; but since M. Richerand and Bichat showed that the projection of the internal extremity of the scaphoides may be felt under the skin, the difficulties which formerly accompanied the operation have been removed, and it is now one of the easiest in surgery.

1st. *Process of Chopart.*—The position of the limb and that of the surgeon should be the same as for the preceding disarticulation. A transverse incision is first made two inches in front of the malleolus. At the extremities of this incision two smaller ones are made; the trapezoid or quadrilateral flap which results is dissected, and turned back towards the leg. The operator opens the articulation from the internal side of the foot towards the external, and in passing through it divides the calcaneo-scaphoidean ligament; arrives at the plantar face of the scaphoides and cuboides, and finishes by cutting the flap as far as the heads of the metatarsal bones.

2d. *Process of M. Richerand.*—Messrs. Walther and Græfe, still describe the partial amputation of the foot in the same manner as Chopart, although

the modification proposed by Bichat and M. Richerand had been adopted for some time in France; that is, instead of forming the dorsal flap by three incisions, to make one semicircular incision convex forwards, which is placed only a few lines in front of the articulation. Klein and Lisfranc have proposed to draw it directly over the articulation.

3d. *Process of M. Maingault.*—M. Maingault proceeds from the plantar to the dorsal face, in disarticulating the bones of the tarsus from one another, the same as in removing the metatarsus and metacarpus, and thinks that this process should be adopted, at least as an exceptionary method. On that point, I am entirely of his opinion.

Remarks.—It is superfluous to discuss the relative importance of these varieties of the general operations. All may find their application in practice, if, for example, there are soft parts only on the dorsal face susceptible of being preserved; it is evident that the flap should be taken from those parts entirely, or from the inferior part, if the teguments on the back of the foot are disorganized up to the leg. If there is not enough of the healthy tissues, either above or below, singly to form a flap capable of covering the wound, I do not see why two of equal extent should not be cut. But if the sole of the foot be not too far disorganized, Bichat's plan is certainly the best and most rational.

4th. *Process adopted by the Author.—First Stage.*—While the assistant compresses the arteries and draws back the integuments, the surgeon embraces with one hand the back of the foot, in such a manner that his forefinger presses upon the tubercle of the scaphoides, and with a little knife in the other hand makes an incision slightly convex in front, the extremities of which correspond to the extremities of the articular line, and which he carries from the internal to the external side of the foot, for both feet if he is *ambidexter;* otherwise, from the external to the internal side for the left foot. After having caused the tissues to be withdrawn, and carried the instrument back to the bottom of the wound, he divides in the same direction, near the retracted skin, the tendons and the other layers which still cover the osseous surfaces, and generally opens the articulation by this second stroke:

Second Stage.—If not, then after again assuring himself of the situation of the scaphoidean tubercle, he cuts from within outwards all the ligaments on the dorsal face which unite the scaphoides to the astragalus, without endeavoring to penetrate the articulation, as the head of this last bone would prevent this. He describes in this way a semicircle, taking care not to prolong the external branch too far behind, but on the contrary, in order to detach the cuboides; to incline the edge of the knife first transversely, then a little forwards; and, as soon as the surfaces are sufficiently separated, to divide the thick fibrous mass which unites the calcaneum to the scaphoides, and finally to arrive at the plantar side of the articulation.

Third Stage.—The operator then directs the edge of the knife forwards along the inferior face of the tarsus, and cuts the plantar flap; lowering his wrist for the left foot or raising it for the right, so that the flap may not be thinner on the inner edge than on the outer, and prolongs it more on the internal side than on the external, because the astragalus ascends towards the leg higher than the os-calcis. As the vertical thickness of the osseous surfaces, here exposed is much greater than after the disarticulation of the

metatarsus, the flap ought to be extended in front as far as in that operation, although this is commenced nearly two inches farther back.

Dressing.—To tie the arteries as fast as they are opened, as Chopart has advised, is a useless precaution. After the operation, the anterior tibial and the two plantars are all that require attention. The dorsal integuments are also brought forwards.

The plantar flap is applied against the cartilaginous surfaces, and retained there by long strips of diachylon, and by a rolled bandage accurately applied.

Art. 4.—*Comparison of the two partial Amputations of the Foot.*

Since skillful surgeons have shown that it is possible to disarticulate the metatarsus as well as the anterior range of the tarsus, it has been asked which of these two operations should be preferred. This question should not have been raised; they are not intended to supersede one another. Each of them has its special applications; and if there be any difference between them as to difficulty, pain, and danger, it is not sufficient to countervail the rule before laid down—to amputate as near the toes as possible.

Art. 5.—*Extraction of some of the Bones of the Tarsus.*

Many surgeons extract the astragalus, and thus preserve the use of the foot and leg. Cases are related by Dupuytren, Despeaux, Fallot, Dassit, Charley, Lockeman, and Modesti.* But it is only in case of luxation, with laceration of the soft parts, that such an operation is necessary. As the same condition of the parts is seldom found in two different cases, it is impossible to give fixed rules for operating. We must be governed by existing circumstances: observing at all times to divide as few tendons as possible, and to operate before general reaction manifests itself, and as soon as possible after the accident. The cuboid, scaphoid, and great cuneiform bones, may each be removed when they cannot be preserved, as in a case of luxation complicated with caries or necrosis. Here, too, the surgeon must also be governed by the circumstances of each case.

Art. 6.—*Extraction of the foot.*

Besides the rule, in other respects so just, that we should only remove the least possible of parts, surgeons have asked if the disarticulation of the foot ought not to be preferred when it may prevent the amputation of the leg? if after this disarticulation it will not be possible for the patient to walk with a peculiar shoe, a sort of half-boot, which will conceal his deformity? It has been performed once with success by Sedillier. He, Laval, and Brasdor, affirm that the cicatrix, which was quickly formed, never reopened during the twelve years that the patient subsequently lived. Hippocrates, F. de Hilden, and Scultetus seem also to have thought of it, though very vaguely. Since then others have again proposed it, without succeeding however in introducing it into practice. The projection which the tibial malleolus presents, would prevent the cicatrix according to some, from supporting the weight of the body after the cure.

* In the case of the patient treated by Dr. A. H. Stevens, in 1826, the tibio-tarsal articulation remained movable, and the foot but slightly disfigured.

The want of soft parts and the numerous tendons that surround the articulation, not permitting us to expect immediate union, must beget strong fear of serious consequences. But are not the most of the dangers and difficulties imaginary? It is certain, as Brasdor has already observed, that the malleolar points soon become blunted, and the whole extremity of the member rounded; and that it is possible to save skin enough to cover a great part of the wound. Some theoretic objections which have been advanced are not a sufficient basis for a definite opinion in such a case, and I think that if favorable circumstances should present themselves, it would be proper to make some trials. M. Confrie long since observed an old soldier at Saint Catherine, who underwent it in the Russian campaign, and who walks very well with a half-boot.

Operation.—The operation itself presents no difficulty. Two semilunar incisions, one passing over the instep, the other over the heel, at twelve or fifteen lines before and behind the articulation, and uniting so as to form another semilunar one on either side at about an inch below each malleolas, constitute the first step. After dissecting up the skin, the tendons, muscles, and ligaments are to be divided as near as possible to the articulation. Then the astragalus can be separated without difficulty, and removed with the rest of the foot. The hæmostatic means having been applied, I would recommend the lips of the wound to be brought together anteriorly and posteriorly so that its angles should cover the malleolar points. It is for this that I propose to divide the integuments at some distance from the ancles and the articulation, and not quite upon them, as recommended by Brasdor, Sabatier, and others. By placing the flaps laterally, as Rossi advises, the malleoli will render their coaptation altogether impracticable; and it would be ridiculous at this day to attempt to hold them, by passing a double ligature across the articulation, as this author is said once to have done with success.

Art. 7.—Amputation of the Leg.

This amputation is more rarely practised than formerly; but is even at the present time often rendered indispensable, by diseases of the tibio-tarsal articulation, complicated fractures, wounds from fire-arms, gangrene, &c.

Place of Operating—of Election.—The rule which requires that an amputation should be made as far as possible from the trunk, has scarcely ever been applied in this case. The place of election for dividing the bone, even when the disease does not reach above the inferior articulation, is at two or three fingers' breadth from the tuberosity of the tibia. The tendinous expansion of the sartorius, the gracilis, and semitendinosus, will be preserved. The stump, which will retain its power of flexion and extension, will be sufficiently long to allow the knee to be fixed firmly and easily upon the artificial leg. It is easy to save enough of the soft parts to cover the wound. By operating too near the malleolus nothing is met with but skin; the cicatrix forms slowly, remains tender, and is easily torn. After the cure, the stump projecting too far backward and constantly exposed to injury from surrounding bodies, must become more embarrassing than useful; so much so, that some subjects operated upon in this way have of their own accord desired another operation; of which Sabatier has given some examples, and on which Pare

has made some remarks. Higher up the saw will divide the tibia in its thickest and most spongy part, and the fibrous expansion that propagates the action of certain muscles of the thigh upon the stump: such at least are the motives which have been invoked for a long time to support a precept which is now questioned. However, Soligen, who lived towards the end of the sixteenth century, strongly opposed this doctrine. According to him we should amputate the leg, like the arm, as low down as possible. With the aid of a shoe, supported by two thin and polished plates of steel, fixed upon the side of the leg by means of *engrenures* skillfully arranged, the patient could walk with almost as much facility as with the natural foot. Many foreign surgeons agreed with him, and Dionis was not far from adopting his opinions. There had been, however, nothing further said about this when Ravaton, White, and Bromfield, towards the middle of the last century, made as they thought the discovery of it. Like Solingen, these authors extolled the employment of machines, and among the rest that of Wilson, which permits the flexion and extension of the leg, and of walking in fact as with a natural member. Ravaton's boot, fixed by means of straps, had a vacuity corresponding to the cicatrix, in order to preserve it from compression. But Sabatier properly objects to this, that the weight of the body forcing the integuments of the stump upwards, must strain the cicatrix so much that it will be torn. M. Larry is of the same opinion. Vacca, Brunninghausen, and Soulera, have nevertheless ventured to restore it to use at the present time: the amputation of the leg at its inferior part is a much less serious matter, it must be acknowledged, than at what is called the *place of election*, since there is less of the soft parts met with there. The integuments that are preserved are sufficient to produce union even by the first intention. It cannot be thought impossible to construct a machine so perfect as to resemble the abstracted member, and allow of its use with little evident deformity. Solingen, White, Ravaton, Bell, Bromfield, and many German surgeons, report cases to prove the contrary. But if some patients suffer from this plan, it does not follow that it should be rejected with all others: success in such cases must depend on many circumstances which have not, I think, been properly estimated. It may be that the cicatrix shall be more or less solid, or placed at the centre or towards the circumference of the stump. Allowing that we have not yet given the boot all the qualities desirable, it does not follow that this is ultimately beyond the reach of human invention. The two subjects thus operated upon that have been presented to my observation, could travel with a boot so imperfect, that I can hardly believe in the absolute necessity of making the knee the point of support for the artificial member. Hence I conclude that with subjects who are not obliged to make long and fatiguing efforts at walking, or who are desirous of maintaining the appearance of the natural form of the part, Solingen's method may sometimes be adopted. If I am not deceived, there would in that case be some advantage in dividing the integuments in such a manner that the cicatrix would form behind, and not at the centre of the stump.

Some persons have placed the point of election either higher or lower than I have done. Hey, for example, places it in the middle of the member. M. Garigue, on the contrary, with de la Motte, and Bromfield, advises us to amputate much nearer the articulation, and even above the tuberosity of the

tibia. M. Larry strongly counsels this course, and M. Guthrie also formally approves of it.

The Place of Necessity.—Yet the point where these different surgeons amputate, should be considered as a place of necessity rather than of election. On this subject I perfectly agree with them, and would always prefer the amputation of the leg, were it but at an inch below the articulation, to the amputation of the thigh, if it be not allowed to amputate in the joint. I even believe, that as a general rule it would be better to cut the bone immediately below the tuberosity of the tibia, than in the place commonly preferred. The section of the tendons and ligaments does not prevent these and their muscles from maintaining their action upon the superior extremity of the leg. Here there is no interosseal space. The popliteal is the only artery to be secured; at least the peroneal and posterior tibial are the only others that can require attention. The head of the fibula may be removed. Then the amputation of the leg resembles that of any single-boned member of the skeleton. The spongy nature of the tibia, so far from being an inconvenience, on the contrary offers the advantage of an immediate union, and an easy and prompt development of cellular granulations. But it must be confessed that the integuments alone exist on the anterior semi-circumferences of the member, whilst below the muscles come to our assistance; but as it is the integuments that ultimately close the wound, I cannot see any great disadvantage to result from this circumstance. So that if the spongy substance of the tibia, in contact with the pus, does not expose the subject to phlebitis and the reabsorption of morbific matters; if in operating above the head of the fibula there be no risk of opening the synovial sac of the knee (which sometimes prolongs itself so far, according to Berard, who has communicated two examples of it, and as I have myself once seen), I would approve without reserve of the doctrine of Garrigue and Larrey. When the disease reaches very near the knee, to preserve the inferior attachment of the rotular ligament, and to leave untouched the mucous bursæ situated behind, M. Larrey recommends that the saw should be applied more or less obliquely from before upward, and backwards. We may thus remove the whole of the fibula, whilst we leave a small portion of the tibia, which will serve equally well for the point of support for the artificial limb; but in such cases it seems better to amputate in the joint.

Anatomical Remarks.—After the preceding details, there is no necessity here for a prolonged description of the leg. The tibia, much thicker than the fibula, and much more elevated, causes the greatest thickness of the member to be from within outward, and from before backward, instead of transverse. Its internal face is entirely uncovered by muscles, and cannot be covered either circularly or with a flap, except by the integuments. Its sharp edge, a kind of crust which presents anteriorly, gives to this portion of its section a point commonly very sharp and capable of proforating the skin, if proper attention be not paid to it. The muscles of the leg that fill the external interosseal fossa, adhering through almost their whole extent to this excavation, are incapable of retracting more than a few lines after being divided. It is the same with the lateral peroneals that form the deep muscular layer of the limb, and the flexors of the toes which fill the posterior interosseal fossa, whilst the gastrocnemius and soleus can retract very considerably when we operate

very low. The anterior tibial artery bending at a right angle as soon as it gets upon the interosseal ligament, soon joins the nerve of the same name. The posterior and anterior tibial arteries which separate either higher or lower from the popliteal, are rarely wanting: the first is found behind the external border of the tibia, on the posterior face of the common flexor and the tibialis posticus; the second behind the fibula, in the thickness of the fibres of the long flexor of the great toe. And the nerve is almost constantly placed upon the fibular side of the tibial artery.

Manual.

The leg may be amputated by either the circular or flap method.

A. *Circular Method.—Position of the Patient, of the Assistants, and of the Operator.*—The patient should be placed upon a bed or a table, and properly supported. To guard against hemorrhage, compression must be made upon the femoral artery over the os pubis, by the thumb of an assistant, a handled pad, or some other instrument; or on a level with the lesser trochanter against the internal face of the femur, by means of the fingers sunk into the groove formed by the *vastus internus* before and the abductors behind; or, in fine, by the tourniquet or garot. When the assistants are not sufficiently numerous, or cannot be entirely depended upon, the garot or tourniquet is to be preferred. These instruments may be employed with the greater security, inasmuch as being applied upon the thigh they in no wise incommode the operator during the amputation. The operator places himself commonly on the inside; this is a long-established general rule; the reason assigned for which is, that it is more easy to terminate the division of the fibula before having entirely got through the tibia, than if the operator were on the outside. Le Dran had remarked, however, that the surgeon could, if it were necessary, disregard this rule without danger and even perhaps with advantage. M. Græfe and S. Cooper, maintain that it is as well that the surgeon should always place himself on the outside; but that it is useless to keep this latter position for the amputation of the right limb. In a word, though on the left, the corresponding hand turned towards the head of the member can draw up the integuments as they are divided by the right, for the other limb this is not possible, when the operator follows the general rule. Consequently the precept which it is proper to substitute for the ancient, and to which I have for a long time conformed, is this: *the operator shall place himself in such a manner that the left hand can always embrace the limb towards the knee;* at least if he be not ambidexter. But if he be, it would be better to place himself on the inside for either, than on the outside for both. It would be idle to place himself on the outside for the division of the soft parts, and then inside for the bone, as some German and English surgeons have recommended. It would be still more improper to leave the sound limb between the operator and the limb that he wishes to amputate, under the pretext of never placing himself between the limbs. The foot and whole diseased portion of the limb being enveloped in a cloth, is confided to the care of an assistant.

2d. *Ordinary Process—First step.*—Armed with an amputating knife the operator makes a circular incision through the skin, commencing at the crest

and finishing at the internal border of the tibia, uniting by a second cut the two extremities of this incision; unless, by a rotatory motion of the hand upon the handle of the instrument (a movement I have indicated above), he should prefer to pass over without stopping the whole circumference of the limb; draws up with the left hand the integuments thus divided; cuts their cellular attachments, and raises them to the extent of an inch or an inch and a half; or better, seizes them by their superior lip between the thumb and finger, near the fibula, dissects them by rapid strokes of the knife or bistoury, and reverses them quickly upward, so as to form a sort of collar or ruffle.

Second step.—After having applied the knife at the base of this collar or circle of the skin, and upon the same point of the tibia as before, the operator cuts backwards and outwards so as to divide the aponeurosis and all the fleshy fibres above the level of the anterior interosseal fossa. By depressing the wrist he divides the peroneal muscles in the same manner; then, by bringing it back gradually inwards, those of the calf or posterior face of the leg; again carries the instrument in front; detaches the aponeurosis on each side, and applies the heel of the knife immediately upon the external face of the fibula; draws it from heel to point, and when the latter reaches the internal face of the bone, obliges it to pass through the interosseal space; divides all the deep-seated fibres; divides those which adhere to the external face of the tibia whilst withdrawing the instrument; carries the instrument under the limb to the same point of the fibula; brings it back upon its posterior face; passes again through the interosseal space, drawing it out in the same manner as before; divide all the muscles still remaining behind the tibia; and thus he will find that he has traced out the figure 8 by his movements, as has already been observed in the amputation of the fore-arm. It is well, as in this latter member, to make a second incision with the bistoury upon each edge of the interosseous membrane. Then pass from behind forwards the middle strip of a three-headed bandage between the bones. The pieces of this bandage suitably applied and brought together, are given to an assistant to draw up the soft parts.

Third step.—The surgeon fixes the nail of the thumb at the point to which the tibia has been denuded; applies the saw upon this point and gives it a few limited movements, then elevates the wrist so as to cut the fibula completely first, and finish upon the bone on which he had commenced; because the fibula alone would not offer sufficient resistance to the action of the saw, and its superior articulation would be exposed to a serious concussion. This second reason appears to me none the less conclusive, although the first is sufficient to justify the precept. As soon as the fibula is divided, the assistant holding the inferior part of the limb, and the operator holding the superior part with his left hand, must compress it enough to prevent its being touched or moved by the saw. M. Roux recommends it to be divided higher up than the tibia. It is for this reason that he inclines the saw obliquely upwards and outwards. By this means M. Roux proposes more surely to guard against the consecutive projection of the fibula. It is of little importance. The section of the two bones on a line is not sensibly less advantageous. I see still less reason to imitate some surgeons who saw them separately. In fine, if the surgeon should choose to operate on the outside instead of the inside, after

having formed a groove of a certain depth upon the principal bone, it will be sufficient to direct the assistants to pronate the limb, and then depress the wrist a little to render the division of the fibula more easy.

The anterior angle of the tibia upon which the skin rests, and against which it is pressed by the force of the muscles of the calf which tends to draw it backward, sometimes produces a perforation of this membrane. The surgeon should have in his mind the means of combating such an accident, of which the amputation of the limb at a high point is ordinarily a successful one. I have seen MM. Richerand and Cloquet, at the Hospital Saint Louis, prevent it when it was threatning, by applying upon the posterior face of the stump a piece of pasteboard *en forme d'atelles*. A much more certain means is to remove the angle or osseous edge itself by a cut of the saw. It is not known to whom belongs the first idea of such an improvement. It has been used for a long time by military surgeons.

Process of Sabatier.—The method of Sabatier differs from the foregoing only in this; he advises the operator to divide the anterior half of the integuments of the member; first, to draw them upwards and continue then the circular incision behind somewhat higher up. The reason that he gives is, that upon the calf of the leg the skin retracts with the muscles, whilst before upon the tibia and anterior aponeurosis, this does not take place. This modification, although not bad, is generally neglected.

Process of Dr. Physick.—C. Bell claims the honor of the invention of a method which Dorsey gives to Dr. Physick. It is, to divide first the skin and then the muscles of the calf very obliquely from below upward, so as to complete the section much nearer the knee, upon the anterior half of the member, and terminate the operation as in the ordinary manner.

Process of M. Baudens, or B. Bell.—After dividing the soft parts circularly, M. Baudens advises us to detach all the muscles to the extent of one or two inches, with the point of the knife held parallel to the axis of the bone. This advice, given by B. Bell for amputation of the arm or thigh, for amputation in general may be useful, and accords with that recently given by M. Hello.

Dressing.—In the place of election the operator successively seizes the anterior tibial artery, which is in contact with the nerve, from which it is necessary to separate it; the posterior tibial, the peroneal, and some branches of the gastrocnemials; and sometimes, the nutritive artery of the tibia. Very often the first of these vessels retracts far into the flesh; the reason of which, M. Ribes says is the double curvature which it undergoes to get before the interosseous ligament. M. Gensoul, on the contrary, thinks that this retraction appears to occur because the fleshy fibres surrounding it are too adherent to contract; thus making the contraction of the artery appear much greater than it really is, and much more so here than in the posterior parts, where the muscles draw them up much higher. Without rejecting entirely the first of these two explications, I freely adopt the second.

When the section of the bone is made immediately below the tuberosity of the tibia, a single trunk replaces the posterior tibial and peroneal arteries, but then the nutrient artery presents a considerable volume. Higher still the anterior tibial itself may not be separated from the popliteal, which in this case requires only one ligature, with the inferior articulating and gastrocnemial arteries.

Surgeons do not all agree upon the mode of uniting the wound. In France it is almost always done from within outward and from before backward. Many English operators, Mr. Hutchinson among many others, still close as formerly, *i. e.* directly from before backward, thereby hoping to escape the stagnation of the fluids, and the pressure of the point of the tibia against the skin. Again, there are others who, after the advice of Mr. Guthrie, unite it transversely: but it is indisputable that when the operator has taken the precaution of paring the bone, as it is called, the method of M. Richerand is the best; that this alone permits the bringing together of the flesh into the smallest space, and that this alone opposes in no way the flow of the pus.

If the amputation has been made very low, the limb must be supported upon a cushion lightly flexed, and inclined upon its external edge; sometimes the stump is placed upon pillows, which very much relieves the ham, and prevents the wound from coming in contact with the matrass.

The Flap Operation.—It was on the leg especially, that Lowdham, Verduin, Sabourin, &c. wished their method applied. It was also on this part that Garengeot, de la Faye, and Le Dran made their first attempts. But the exertions of Louis, Lassus, and Sabatier to disseminate the circular method, and the apparently greater pain and difficulty of the flap operation, caused the latter to be almost entirely renounced. M. Roux and Dupuytren, however, again introduced it amongst us about twenty years ago. Dr. Hey in England, Klein and Benedict in Germany, have also succeeded in introducing it among some of their countrymen. It appears to have been rejected by the moderns, especially on account of the volume of the tibia, the internal face of which, whatever plan may be pursued, can only be covered by the skin. The necessity of making the flap chiefly, if not entirely from behind, is another motive for its rejection. However, as there may be cases that render it indispensable, I feel bound to point out here the principles upon which it is to be performed.

1. *Process of Verduin.* A two-edged knife, entered a little below the point at which the saw is to be applied, is made to form a semilunar flap at the expense of the calf, about four inches long; bringing it in front you immediately divide the integuments and muscles, as in the circular method, to the base of the elevated flap; the interosseal parts are cleared, and the bone sawn as in the ordinary method.

2. *Process of Hey.*—To be more certain of the length of the flap, Dr. Hey advises us to make one circular line at half height of the tibia, a second an inch below, and a third four inches below the first; then two others parallel to the axis of the member, one on each side, and which stretch from the union of the two anterior thirds, with the posterior third of the superior circular line, as far as the last. The first line indicates where the bone is to be divided with the saw, the second where the integuments are to be divided anteriorly, and the third the place where the knife must be stopped; whilst the two lateral lines trace the form and extent of the flap, which Hey in other respects formed like Verduin and Lowdham. No operators at present, I imagine, will be tempted to use these architectural delineations and geometrical rules.

3. *Process of Ravaton.*—The circular incision, made at four inches from the place where the amputation should be performed, admits of another on

the face and near the internal edge of the tibia, then a third upon the external edge of the limb, which must fall at right angles upon the first. The two square or trapezoid flaps, one anterior and the other posterior, that result, are then dissected upwards and raised; nothing more remains but to free the interosseal space, pass the compress, and saw the bone.

4. *Process of Vermale.*—To form the first flap, Le Dran, who is said to have used the methods of Ravaton and Vermale successfully, pushed the knife from the internal to the external face of the limb, and began by forming the anterior flap; nothing is then more easy than to force back the flesh and make the posterior flap.

5. *Process of M. Dupuytren.*—Instead of beginning with the anterior flap, M. Dupuytren passes the instrument between the posterior face of the bone and the soft parts, taking care to leave more flesh than Le Dran, behind the fibula.

6. *Process of M. Roux.*—As it is almost impossible to preserve as much of the tissues before as behind, M. Roux first conceived the idea of making upon the internal face of the tibia, an incision about two inches long, obliquely forwards and downwards, beginning at the internal and ending at the anterior edge of the bone; when the posterior flap has been formed, this incision admits of the bringing back of the edge of the wound easily to the level of the crest of the tibia; thus making the anterior flap more regular and thicker.

All of these methods may be reduced to that of Lowdham and that of Vermale; one by a single flap, the other by two. When the skin is disorganized much higher before than behind, and the amputation must be performed very near the knee, the first is necessary. I have seen it used with success by M. J. Cloquet, at the *Hopital de Perfectionnement*, on a subject who without it must have lost his thigh. In all other cases the double flap method appears to me most proper, although a little more difficult. When there is only one flap, it must necessarily be bent at a right angle at its base to apply it upon the bone. Immediate and complete union is almost impossible. It is rare that it is not succeeded by very lively pains. The consequences that may result from it, justify to a certain extent the fears of some surgeons, and their repugnance to its performance. With two flaps, on the contrary, the wound closes very easily; the parts are neither bent nor stretched, and are thus in the most favorable condition possible for immediate reunion.

7. *Process of the Author.*—In trying upon the dead subject the method of Vermale, which I have once performed upon a living one at the *Hopital St. Antoine*, I neglect the little preparatory incision of M. Roux, but I take care to embrace both sides of the limb with my left hand, and to draw as much of the integuments as possible forwards. The point of the knife is then applied upon the internal face of the tibia; brought to the level of the crest of this bone, pushing the skin before it; slipped behind the interosseous ligament; raised a little to pass behind the fibula, and again inclined backwards; whilst the tissues are drawn towards the body of the operator until the moment it passes through the external edge of the member. This flap finished, a similar one is formed behind, and the rest of the operation performed without variation from M. Dupuytren's method. By every method it is necessary that the internal angle of the wound should be a little lower than the external, if we would not expose the bone to denudation or necrosis.

2. *In the Articulation.—History and Value.*—Although vaguely indicated by Hippocrates and Guy de Chauliac, a little more clearly mentioned by F. de Hilden, the disarticulation of the leg never attracted much attention until the latter part of the last century. At the present time, notwithstanding the efforts of J. L. Petit, Hoin, and Brasdor, who endeavored to restore it, it is not now recommended by any one: and M. Blandin is almost the only person who has dared to reproduce the arguments of Brasdor in its favor. The operation therefore at first view seems to deserve to be erased from modern surgery. Is this a judgment without appeal? I think not.

De la Roche tells us that a young girl, aged seventeen years, underwent an amputation in the knee, and that she was perfectly cured. In one case mentioned by J. L. Petit, the disarticulation of the leg appeared only to have been preferred because of the want of instruments to amputate in the continuity of the limb. Another was that of a young man, who had both bones of the leg exostosed and carious throughout their whole extent. We have every reason to believe that these two cases, of which Petit was only a witness, were amply successful. A slater who had fallen nineteen days before from a height of one hundred and thirty-two feet, was taken to the Hospital of Dijon, July 26, 1764. His leg was gangrened to the knee. Hoin disarticulated it, and although there were not soft parts enough to permit immediate union, this man was ultimately cured. In the month of July, 1771, he was still alive, used his wooden leg freely, and could mount the scaffold or roof as before the accident. Gignoux, of Valence, speaks of a young woman who had had the leg separated from the thigh by gangrene, and whose health was entirely restored in four years. Sabatier is said to have seen a boy whose leg was carried away by a ball without injury to the patella, and who suffered nothing serious from the accident. In 1824, Dr. Smith, Professor of Yale College, in America, had recourse to disarticulation in the case of a lady, who since has never ceased to be able to walk with a wooden leg. A scrofulous subject, aged nineteen years, was operated on in the same way at the *Hopital de St. Louis*, in 1824, by M. Richerand. Various accidents, some abscesses, and purulent fistulæ of the thigh, at first alarmed the surgeon, but the wound nevertheless ultimately cicatrized. A man, amputated at the knee, was met with in the streets of Paris by M. Dezeimeris, in 1829. This man walked freely, but with a *cuissart*, and without using the stump as a point of support for the artificial member. Dr. Bourgeois informs me that he has seen a similar case at Etampes. Rossi regards it as the most simple method, and is said to have twice performed it successfully. Finally, a case of disarticulation of the leg is mentioned in the first volume of the *Dictionnaire de Medecine et de Chirurgie Pratique.* The patient operated upon at the Hospital Beaujon died the sixteenth day after the operation, from the consequences of phlebitis.

Here then are fourteen well authenticated cases of amputation of the leg in the articulation, and of this number thirteen incontestable examples of cure. It cannot be denied that these first results are very encouraging. Amputation in the continuity has certainly never given more satisfactory ones. To those who would object that in Gignoux and Sabatier's patients the operation having been performed as much by nature as by surgery, nothing can be concluded in favor of ordinary cases; that gangrene had also performed part of the amputation in Hoin's subjects; that that of M. Blandin

ultimately succumbed; that they were all young subjects, and that with all it was a long time before they could use the stump; it may be replied: 1st. That if the wound closes well after the spontaneous separation of the limb, or when gangrene had already attacked the tissues, there is no reason why it should be otherwise in consequence of an artificial operation. 2d. That the accident, of which one of the patients became the victim, belongs no more to disarticulation than to the simple operation for amputation of the leg, and that his death eight months after was the result of his primitive affection. 3d. That there is no evidence that there should be less to hope for in this operation with adults than with adolescents. 4th. That the length of the cure must be attributed to the peculiar circumstances, and not to the operation. 5th. In fine, that Dr. Smith did not complain of any of these inconveniences. But let us contiuue the exposition of facts.

In the month of January, 1820, I received at the hospital *Saint Antoine*, an orphan, aged nineteen years, who was sent to me by M. Kapeler, chief physician of the house. The operation was fixed for the 14th of the same month. As there were not soft parts enough behind, I thought it proper to preserve enough in front for a flap of a given extent. The wound united but incompletely. No accident followed; and although there remained a transverse surface of about an inch in width antero-posteriorly, which the flap did not cover, the cicatrix nevertheless was completed by the end of two months. At present this subject enjoys sound health; the stump supports the weight of the body upon a wooden leg with the same facility as if it had been subjected to an amputation in the continuity of the limb. A man, aged twenty-nine, well made, born in the colonies, was sent to me in the hospital *Saint Antoine*, the 24th of the following May, by Dr. Thierry, to be treated for a comminuted fracture of the left leg. Gangrene soon manifested itself. An ichorous suppuration more and more abundant, an excessive pain at dressing and even during the intervals, and almost continual fever, diarrhœa, &c., soon supervened, and took away all hope of preserving the limb. I then decided to amputate in the knee joint, and performed this operation on the 4th of June. The fever of reaction, which continued high, obliged me to bleed on the first and second day. Nothing of importance further occurred up to the fifteenth day. On the sixteenth and seventeenth an erysipelas supervened, and returned the fever. Notwithstanding this, intercurrent phlegmasia, together with two purulent collections which afterwards formed at the angles of the condyles, and derangements produced by errors in diet—a true indigestion in fact—the cure was completed towards the sixtieth day. At present this patient uses a limb of wood with the same facility as the preceding patient. In the month of July, 1830, I had to examine, at the central bureau of the hospital, a young man, aged nineteen, who had undergone an amputation seven years before, and who came to request a renewal of his wooden leg. He informed me that it was at the *Hopital des Enfants*, to which he had been sent for grangrene, that he had submitted to the operation in the knee. The cicatrix is behind, and although the internal condyle, an inch longer than the other, is the only part that presses upon the artificial member, yet he moves about as well as if he had been operated upon below the articulation. Since then it has been performed once successfully by Mr. Nivert of Azai-le-Rideau, in a male adult who had had

the limb fractured by a gun-shot. I have been told, however, that two other operators have not had the same success. But I know from M. Blandin, that the state of his patient scarcely left any hope before the operation, and I am ignorant of the details of the other case. It was not so with two subjects upon whom I operated this year at *La Pitie;* the one an old man, affected with senile gangrene, died the 28th day, the mortification having renewed itself upon the stump. The other a woman extremely fat, with the limb suffering from an enormous cerebroid cancer, which did not permit me to preserve any thing but the integuments on the inner side, was taken with a suppuration of the entire thigh and a large ulceration on the sacrum. She died the sixty-second day, without showing any thing wrong about the wound.

Instead of opposing experience, this gives high evidence in favor of this operation. And what reason can there be opposed to it? Will some object, 1st. That by uncovering such large osseous or cartilaginous surfaces it exposes to very formidable consequences? As the continuity of the bone is not affected, nor the periosteum destroyed, there is nothing to fear from the contact of the air. The cartilaginous plate which envelopes the condyles is a protection, quite insensible, that may remain for weeks entirely naked without the least inconvenience. The synovial membrane that Bichat has given it, does not exist. 2d. That it will produce an enormous wound, which it will be almost impossible to cover with the adjoining soft parts? This is an error. This wound, so vast in appearance, is reduced by analysis to the division of the integuments, several fibrous laminæ, and some muscles. Provided the skin can be saved for the extent of two or three inches, it will always suffice for immediate reunion. 3d. That it is concerned with tissues which do not readily inflame or admit of a ready and firm cicatrization, as in the fleshy parts of the limbs? There is an error prevalent on this point as upon the other. Nothing is better than a tegumentary couch; it is all that is absolutely necessary to the formation of a good cicatrix. As it covers the whole synovial surface of the femoral condyles, it will adhere as well, and even more exactly, it may be said, than upon a divided bone and muscles. 4th. That it will be more painful, and attended with a less speedy cure than the ordinary amputation This is not a more solid objection than the preceding; the facts above stated give sufficient proof of this; and the more as the subjects of it were certainly not all in the best condition for a prompt cicatrization of the wound. 5th. It is accused—and this reproach is the one upon which objectors most insist—of leaving the patient in the same state after the cure, as those who have been operated on at the thigh; that is, of being obliged to make use of a *cuissart* instead of a wooden leg in walking. I confess that this apprehension for a long time arrested me. But it is useless to refute it here; the three patients upon whom I have already remarked, are placed there to reduce it to its just value.

Why then should it be proscribed? After the amputation of the thigh, no matter how low down, the point of support for the artificial limb must be taken upon the ischium. The movements of the haunch are almost entirely annihilated. Progression is performed as if the coxo-femoral articulation had been anchylosed. On the contrary after disarticulation of the leg the point of support is the extremity of the femur. The thigh preserves all its movements, and the patient is in the same condition as if he had a simple

consolidation or anchylosis of the knee. If it be true that as to the functions of the member it is infinitely better to amputate in the continuity of the leg than in that of the thigh, the advantages of disarticulation of the knee must be equally beyond dispute, for the weight of the body is transmitted to the artificial member in the same manner after the latter as the former. The wound appertains almost exclusively to the skin, comprehending neither bone nor aponeurosis; the surface to be covered is convex, regular, deprived of every kind of asperity, and there is no reason to apprehend muscular contraction. In the thigh, on the contrary, the solution of continuity comprehends a great aponeurotic envelope, and all its concentric plates; muscles numerous, and of very considerable thickness; of a bone which divides itself with great facility, and the division of which produces a concussion which is in itself not without danger; and, in fine, of all the cellular tissues that unite these various parts. At the knee only one artery of considerable size is divided; torsion and compression secure it almost as certainly and as easily as the ligature. At the thigh there are, besides the principal trunk, numerous secondary branches, all requiring to be tied with care.

Thus, in theory as in practice, the amputation at the knee evidently offers less danger than amputation at the thigh; perhaps even than in the continuity of the leg itself. I would say further, that the proofs indicate it to be less dangerous than most other disarticulations, although up to the present time it has been practised mostly after very vicious methods, or under very disadvantageous circumstances.

Manual.

The patella which J. L. Petit recommends to be removed, should always be preserved; the contraction of its muscles elevates and soon fixes it above the condyles, where it can interfere with neither the cicatrization of the wound nor the use of the stump after the cure.

1. *Process of Hoin.*—The process of Hoin, carefully described by Brasdor, and which consists in cutting through the articulation from before backward below the patella, and finishing with a large flap made from the calf of the leg, presents more than one inconvenience. The anterior lip of the wound, drawn by the action of the muscles and the natural contractility of the tissues, often mounts above the cartilaginous surfaces. Its angles, separating by the lateral projection of the condyles, in spite of all that can be done, soon leave a part of the bone uncovered. The flap, always thinner at its root than towards its point, adapts itself badly to the parts it has to cover. Besides which, the state of the tissues prevents us sometimes from giving it sufficient size to reach, with ease, the retracted edge of the patella. In fine, it is rare that the cicatrix will be formed so high, that in walking or standing it will not be exposed to pressure.

2. *Process of Leveille.*—In following the advice of Leveille, to form the flap at the expense of the anterior soft parts, the operator can but rarely give it sufficient extent to throw the cicatrix far enough from the resting point of the condyles. This manner of operating has not been reproduced in any other work of surgery than that of Monteggia, who barely mentions it.

3. *Process of M. Blandin.*—Nor can I see what more is to be gained by

commencing, instead of finishing by the formation of a flap behind, nor the advantage to be derived from making a counter-opening in the hollow of the ham for the passage of the ligatures and pus, as proposed by M. Blandin.

4. *Process of Mr. Smith.*—With the two flaps of Mr. Smith, or rather of M. Beclard, I am assured by M. Belmas, who assisted at the operation on the child of whom I have spoken, it is not necessary to preserve so much of the flesh in the calf of the leg. Being forced to pursue this method with my first patient, I was convinced that it offered at least as many advantages as those of Petit, Hoin, and Brasdor. However, whether by one or two flaps, nothing can prevent them from contracting in extent as they increase in thickness, and consequently leaving a portion more or less considerable of the condyles entirely uncovered; so that the cicatrix can only be completed by a tissue of new formation.

Process of Rossi.—Rossi's method, which consists in making one flap inside and another on the outside, instead of before and behind, although still more vicious, should not be entirely rejected, especially when the skin is less altered upon the sides than elsewhere,

New Process.—In the process that I have adopted, the skin is divided circularly at three or four fingers' breadth below the patella, without touching the muscles. In dissecting it away to elevate and evert it, care must be taken to preserve on its internal face all the cellulo-adipose layer with which it is naturally thickened, and not to destroy its smaller blood vessels. An assistant immediately draws it up toward the knee, until in dividing the rotular ligament, the instrument can fall upon the inter-articular line; the surgeon then divides the lateral ligaments; separates the osseous surfaces by flexing the leg a little; detaches the semilunar cartilages; divides the crucial ligaments; goes through the joint, and finishes by dividing at a single stroke, the vessels, nerves, and muscles of the ham, in a direction perpendicular to their length, and on a level with the elevated integuments.

Dressing.—After having tied or twisted the popliteal artery and the less important branches that may require it, the operator turns down the whole of the dissected skin, cleans, and, if he intend immediately to unite them, brings the two sides together so that the angles of the division may be tranverse. But if the union should not be at once attempted, a fine piece of linen, covered with cerate and pierced with holes, should be applied over the whole solution of continuity, which is then filled with lint, and the whole covered with soft pledgets, and enveloped in an ordinary bandage.

By this method the integuments represent a kind of purse or ruffle, which envelopes and covers the condyles as well at the sides as before and behind. As it is a little smaller at the mouth than in its depth, it is similar to a sleeve somewhat tight at the wrist; and consequently offers some impediment of itself to its retraction upon the thigh. The muscles are divided squarely, and where they are very small, present but a very small bleeding surface; leave the skin free, and cannot aggravate the traumatic inflammation or excite any just fear of too abundant a suppuration, as in other methods. In fine, the ligatures, if they are used, are easily applied; and collected at a point so distant from the vessels which they secure, and in such a manner as to irritate but little the interior of the wound.

I would not however conclude from these data, that all other methods

should be henceforth abandoned as useless. If the skin be too much altered before, whilst it is otherwise behind, it would be better to use Petit's method. Smith's process will be in some sort necessary, if the disorganization, being higher on each side towards the condyles than antero-posteriorly, has already traced the limits of the flap. But in other cases, whenever circumstances admit of choice, I will venture to say that the circular method offers the greatest advantages, and should be generally preferred.

Art. 9.—*Thigh.*

§ 1. *In the Continuity.*

Place of Election.—It is not with the thigh as with the leg; here the amputation should be as low as possible. The greater the length of the stump, the more easy is it to apply the substituted apparatus. The operation, already one of the most dangerous class, is still more dangerous the nearer we approach the trunk. It is then astonishing, that M. Langenbeck should recommend it never to be performed below six fingers' breadth above the knee; alleging, as the pretext, that lower down the artery is confined in the sheath of the abductors, and that it will be difficult to draw it out for ligature. As the femoral artery may be reached above or below the fibrous canal which it traverses, or even in the canal itself, it can in no case be difficult to seize, nor require an after-division of the sheath which encloses it. On the other hand, as it is rare that the disease permits the division of the integuments at less than two or three inches above the patella, the section of the femur must almost always be more than five inches above the articulation, and therefore the precept of M. Langenbeck is useless.

Anatomical Remarks.—In the thigh, as in the arm, there are found two beds of muscles, one superficial, composed of the rectus, the sartorius, the gracilis, the semitendinosus, the semimembranosus, and the long portion of the biceps; the other deep-seated, comprehending the three parts of the triceps and the abductors. The first extend from the pelvis to the leg, each one in a sort of distinct cellular sheath, which permits them to move easily beside each other, and consequently enjoying very great contractility. The intimate connexion of the others with the bone, on the contrary, allows them but slight retractile power; hence it is the superficial layer only which contracts after amputation, so as sometimes to leave the femur uncovered and projecting. Near the pelvis, we find, besides the psoas and iliacus, the great gluteal, and the pectineus; then quite high up the other two glutei, the obturatores, the gemini, the pyriformis, and the quadratus, which, by the great separation of their points of origin, tend much more to enlarge the wound than to denude the bone, if the amputation be performed between the lesser trochanter and the hip joint.

The femur, bending slightly forwards near its middle, is enveloped at this point by a bed of soft parts less thick, and by muscles much less retractile before than behind. From which it happens that the cicatrix forms almost always more or less inwards or backwards, and that the extremity of the bone never corresponds to the centre of the stump in those amputated at the thigh. The crest which the bone presents posteriorly, easily splinters under the action of the saw, and consequently requires much care during that part of the operation.

The femoral artery is the only one of importance met with in the lower part of the thigh. As it is covered by the sartorius, it is always easy to find. However, the anastomotica magna must not be forgotten. It is sometimes enveloped by the tendinous fibres of the great adductor, the direction of which it follows, and it is in such cases very difficult to isolate. The deep-seated muscular or perforantes, and, nearer the pelvis, the superficial muscular and circumflex arteries, must be added to the crural; the first over the anterior of the adductor muscles, or in the midst of them; the second under the rectus; the other two, inside and outside, a little above the lesser trochanter

The femoral vein is connected with the artery in such a manner that the precautionary compression of the latter prevents the return of blood by the former; thereby often producing hemorrhage. The great sciatic nerve, loose at the posterior part of the thigh and anterior to the superficial muscles, devoid of all contractility in itself, sometimes hangs out from the wound, beyond which it may project more than an inch, and thereby render the dressings very painful. In such a case the best thing to be done is, as recommended by M. Discot, to cut it off at once. Another branch of the nerve that requires some attention, is that which attends the crural artery. Its diminutive size prevents it from being readily distinguished. Yet, by remembering that it is always upon the anterior and internal face of the artery or vein, an operator will not be much embarrassed in finding and putting it aside.

Manual.

A. *Circular Method.*—All that has been said of the circular method in general applies particularly to this. As it is of all amputations in continuity the most serious and alarming, it is to this that F. de Hilden, Wiseman, Pigray, J. L. Petit, Le Dran, Louis, Pouteau, Valentin, Alanson, Hey, Desault, &c. have particularly referred, in their discussions upon the ablation of the members.

Position of the Assistants.—Placed upon the foot or edge of his bed or a table, with the thigh free to its root, the patient is held by four or five assistants; one for the head and arms, another for the pelvis, a third for the sound limb, a fourth for the leg of the affected side, and a fifth to draw up the tissues. The tourniquet, or the garot, which some persons still use, and every kind of bandage which was formerly applied above the point of division of the flesh to prevent hemorrhage, should be rejected, as preventing, or at least lessening the contraction of the muscles. The practice of Girardeau, adopted by almost all modern surgeons, and which consists in compressing the artery upon the body of the pubis, since it does away with this objection, merits the preference that it has generally received. It will be inexcusable to follow the ancient method, unless under special circumstances in the case, or for want of sufficient assistance. In every case the tourniquet should be placed as high as possible. According to S. Cooper, in order that the left hand may always embrace the thigh on the side next its origin, it is the practice in England for the operator to place himself always on the right of the patient; so that in the amputation of the left thigh the sound member is placed between him and the one to be removed. I need not assign the value of such a precept; every

surgeon amongst us will give it what it merits. In France the operator places himself on the outside for both limbs, and consequently, when operating on the left, he must leave the retraction of the integuments to an assistant.

The first incision, which comprehends as nearly as possible the whole thickness of the integuments, is begun above the knee at four or five fingers' breadth from the point at which the division of the bone is to be made. Whether the aponeurosis and the subjacent muscular fibres be reached or not, is of little importance; the chief matter is the complete division of the skin. In endeavoring to favor its retraction, it should be remembered that it adheres much more firmly to the aponeurosis, on the anterior part of the thigh, than elsewhere.

Second Step.—The knife, again placed at the edge of the retracted integuments, is made to cut the muscles, if not to the bone, at least through the superficial bed. After the retraction of this part, the surgeon again applies the instrument upon the base of the cone formed by these divided parts, and with another cut divides the remaining fleshy fibres; he then denudes the bone, applies the defensive compress, crossing the strips anteriorly, incises any tissue that may yet remain attached to the bone, and then finishes with the saw.

Above the middle of the limb the muscles contract much less; but as the volume of the member is more considerable, it is equally necessary to commence three or four inches below the point at which the saw is to be applied. Perhaps there would be some advantages when the operation is nearer the hip, in using M. Græfe's knife, in order to make a kind of funnel of the soft parts, or else divide them, as Alanson and M. Dupuytren do, by inclining the edge of the instrument upwards. In fact, a perpendicular division produces a wound so square or level, that it is sometimes very difficult to bring its parts in contact. But this inconvenience is easily obviated, by taking the precaution to dissect the skin for two inches, and evert it, instead of merely dividing the cellular filaments that connect it with the aponeurosis, as in the process of Desault. I have seen M. J. Cloquet, in the case of a young subject at the *Hopital de Perfectionnement*, on whom he was obliged to operate at a short distance from the great trochanter, unable to produce immediate union, from having neglected this precaution. The same thing has happened to myself.

The arteries to be tied or twisted in the lower part of the thigh, are the femoral, the great anastomotic, and some articular branches, or those of the last perforating. The number augments as we go up; so that in the higher parts there are the profound femoral, the superficial muscular, some branches of the circumflex, the obturator, and the ischiatic. To give easy escape to the matter formed, French surgeons give the wound such a direction, that one of its angles presents anteriorly, whilst the other is immediately behind. Some of the operators of Great Britain blame this plan as vicious, because the posterior angle must necessarily come in contact with the cushions or matrass. Among others, Dr. Hennen recommends an antero-posterior coaptation of the tissues, thus giving the wound a transverse direction. But without being absolutely necessary, the French method is best. For the position of the stump after dressing, I refer to what has already been said above.

Flap Operation.—As by the modern processes, the circular amputation, well

performed, generally admits of the coaptation of the lips of the wound, and of immediate union, the flap operation has not been tried in such a variety of ways above as below the knee. In spite of the advantages which Ravaton, Vermale, Le Dran, and Desault are said to have obtained from it; notwithstanding those which Paroisse obtained from it on the field of battle; although the seven individuals spoken of by Kleim, were almost completely cured in ten days; and although many other surgeons, both English and German, have used it of late with much success, still it is but very little employed. It is objected, that it is longer and more painful—which objection, in my opinion, has to be proven; that it requires a greater extent of sound parts—an objection perhaps a little more correct; and that it exposes the patient to more serious consequences—and this again is perhaps just. I have never attempted it but once; the bone escaped by the superior angle of the wound, and the patient died. Some surgeons, Mr. Guthrie for instance, who prefer the circular operation under other circumstances, have yet recourse to the flap operation when it is necessary to amputate in the superior third of the thigh. It then certainly offers incontestable advantages for the approximation of the lips of the wound.

1. *Process of Vermale.*—Nothing could induce us at the present day to practise the three incisions of Ravaton, to form the flaps that may be needed. It is infinitely more simple to cut at once through the whole thickness of the member, as advised by Vermale. The patient and assistants being disposed as before, the operator places himself on the outside for the right, and on the inside for the left limb (this position however, he is not bound rigidly to follow); seizes the flesh with his left hand, and draws more or less from the bone; plunges in a long knife till it reaches the anterior face of the femur at some lines below the point where it is to be divided; inclines the point of the instrument slightly so as to graze the external side of the bone; then immediately after gives it its original direction, so as to pass it out at a point diametrically opposite the one at which it entered; and then, by cutting downwards and outwards, forms the external flap, of about three or four fingers' breadth in length, which the assistant immediately raises. The knife is again brought to the anterior angle of the wound, and, the fleshy parts forced away from the axis of the body, it is made to glide along the internal face of the femur, care being taken to carry it behind this bone without cutting the soft parts a second time; and the operation is finished by making a second flap of the same size and form as the first. If, to adopt Dr. Hennen's ideas, the operator wishes to give the incision a transverse direction, the flap operation may still be used; but it will be necessary to make one of these flaps anterior and the other posterior, instead of internal and external. I prefer to begin with the external flap, because, there being less to divide on this side, it is necessary to draw them out as much as possible, that there may not be too much difference in the thickness of the two flaps, and especially because, in this way, we may, if necessary, dispense with the compression of the artery at the inguinal space, since it is not divided until the very moment of the completion of the flap.

2. *Process of M. Langenbeck.*—Instead of commencing the operation by puncture, and then cutting outwards the skin, Langenbeck cuts from the tegumentary tissues towards the bone. The operator places himself on the

inside for the right limb, and the outside for the left member, unless he be ambidexter; has the skin drawn upward by an assistant; seizes the knee himself with one hand, and, with a knife of moderate length in the other, divides with a single stroke all the soft parts which cover the inner face of the femur from below upward, and from the superficial towards the deeper parts, so that his instrument may reach the bone at not less than three inches above the point at which the incision in the integuments was commenced. An assistant then elevates this flap. The operator passes the fore-arm behind, then outside, and then before the thigh, and by a second incision cuts externally another flap similar to the first, taking care to connect its semilunar extremities with those of the internal incision.

In both these processes it is necessary, after making the two flaps, to carry the knife to their base, and divide the soft parts that may yet remain attached to the bone, so that the saw may be applied as high up as the point to which the knife has reached.

It is evident that the operator may content himself with one flap, either internal or external, anterior or posterior, if the state of the skin does not allow room for a second opposite the first, and that all the peculiarities belonging to the flap operation in general apply to that of the thigh in particular. M. Baucel, who is said to have followed the process of Vermale in every particular, is affirmed to have been sixty times successful. M. Hello, who at the suggestion of M. Fouilloy made but a single flap out of the anterior soft parts, maintains, with justice in my opinion, that his method has the advantage of more decidedly opposing the projection of the bone than any other, because the parts are drawn by their own weight over the whole extent of the wound. I doubt, however, if the circular method, well performed, may not be preferable to all these, which should be preserved, as I think, only as exceptionary methods.

In Contiguity.

History and Value.—Morand appears to have had the first idea of amputating the thigh at the articulation, and to have been the first to conceive the possibility of success in this formidable operation. Two young practitioners, *eleves* of Wolher, surgeon to the horse-guards of the King of Denmark, that surgeon himself, Puthod de Nyon, in Switzerland, made the first formal proposition of it to the Academy of Surgery, the 3d of March, 1739, and obtained a favorable report the 26th of July, 1740, from Le Dran and Guerin. Ravaton would have put it in practice in 1743, if some of his compeers, called in consultation, had not opposed it. The 7th of March, 1748, Vallum sustained a thesis of Lalouette's upon the subject, which Morand succeeded in opening to a *concours*, in 1756; and again in 1759, the academy, not having found any work the first time worthy the prize proposed, thirty-four memoirs were received, and that of Barbet crowned. Goursault, Moublet, Le Febure, Puy, and Le Compte, also, have each published a work on the disarticulation of the thigh. Almost all came to the conclusion that it was practicable; some after attempting it upon the dead subject, others from experiments made on dogs. Barbet sustained its practicability from analogy, and upon its result upon an infant, aged four years, affected with gangrene from the use of

ergot, who first had the right, and then, four days after, the left thigh amputated by Lacroix d'Orleans, in the presence of Le Blanc, and who appeared to be on the point of being cured, but eventually died fifteen days after the operation. Perrault of Saint-Maure, in Tourain, was obliged to imitate Lacroix, in 1774, on a subject named Gois, who had had the thigh crushed between a wall and the pole of a coach, and rendered grangrenous almost to the hip. This patient, of whom Sabatier gives us the history, was cured, and for a long time continued to be a cook in an inn, at Saint-Maure, where I myself saw his son, in 1815. Kerr, according to S. Cooper performed the same operation, but unsuccessfully, about the same time, upon a girl aged fourteen years. Pott and Callisen having reprobated it, Bilguer, Tissot, &c., in vain defended it; and at the commencement of the present century it was considered almost out of the question in England and Germany. It was in the French armies that it was subjected to sufficient proof. M. A. Blandin cites three cases of it. He operated on the first of his patients in the month of *Fructidor*, year III, and completely succeeded. The second was equally successful, and the third did not die until the fifty-eighth day. At the same time M. Perret, another military surgeon, performed one successful operation. In 1798, Mulder was not less happy with a girl aged eighteen years. In 1803, M. Larrey had already disarticulated the thigh several times, and his memoirs contain two well-authenticated cases of success; one upon a Russian at Witepzk, the other upon a French soldier at Mojaisk. According to M. Gouraud, Dr. Millengen had two successful cases, which he published in London. M. Baffos attempted it in 1812, at the *Hopital des Enfants*, upon a subject aged seven years, who was cured of the operation, although it died some months after, from the continuance of the scrofulous affection of the joint. A soldier, wounded at Merida, and operated upon by Mr. Brownrigg, so far recovered that he returned to England, where many persons have since seen him. M. Cloquet saw a French prisoner, in 1815, at Val de Grace, who had been operated upon in the same manner, by Mr. Guthrie. Another successful case in France was produced by M. Delpech, and two others in England, one by Sir A. Cooper, in 1824, the other by Mr. Orthon, in 1826. Dr. Mott, of New York, published another, in 1827, and M. Wedemeyer still another. Mr. Lyme's patient, in 1825, was cured in thirty-four days. Mr. Bryce's, in 1825, who was near perishing from hemorrhage, was met some months after by this surgeon, at Poros, in perfect health. So that up to the present time, this operation, which M. Richerand for ten years would scarcely admit as possible, counts near twenty well-authenticated cases of success. But during the same time, how often has it been followed by death? Thompson, Kerr, A. Blandin, A. Cooper, Broocke, Cole, Walther, Larrey, Guthrie, Emery, Dupuytren, Blicke, Krimer, Gensoul, Clot, Roux, &c., have each had the misfortune to see at least one of their patients succumb to it. The second operated upon by M. Delpech, died in about two months. One of those, of Mr. Pelikan, of Wilna, died in ten, the other in sixty days. M. Dieffenbach's survived but ten hours. I performed it once myself, and the patient died on the fourteenth day. We should then only decide upon this amputation, when it is difficult to amputate with some chances of success in the continuity of the limb. M. Larrey seems even to prefer it when it would be possible to saw the bone between the lesser trochanter and the articulation.

I am entirely of his opinion upon this point. The case I have spoken of as occurring to myself, and two amputations of the latter kind which I was forced to perform, have convinced me that he is right. My patient was in such a state of exhaustion when he submitted to the operation, and the disorder had extended so far towards the pelvis, that I could scarcely comprehend how he could have existed even for a few hours under so many lesions. The cases of Barbet, Kerr, Baffos, and Delpech, failed from the progress of the primary affections, and not in consequence of the operation. In the other cases the disease was so serious, that the simple amputation of the thigh in continuity would probably have been followed by the same fate, had that operation been performed.

Hence, a comminuted fracture, necrosis, caries, osteo-sarcoma, spina-ventosa, or any incurable alteration of the femur extending to the head of the bone; gangrene; every disease, in a word, which may attack the hip, and be sufficiently serious to require amputation, calls for this operation, provided the articular cavity and the bones of the pelvis are not affected. Wounds from fire-arms, with lesion of the bone in the superior third of the thigh, give the most formal indication. As it is then necessary to use the knife at a certain distance above the disease, I can see no reason to hesitate in attempting it. Reason, and the facts already known, lead to the belief that, all other things being equal, it is not more dangerous than amputation in the upper fifth of the femur. It is more easily performed and much more prompt. The surface of the wound is not larger. The same muscles and the same vessels are divided, and there is less of the tissues necessary to obtain co-aptation of the parts. If practised in cases less desperate, I am convinced it will be attended with very considerable success.

Anatomical Remarks.—The head of the femur, forming more than a hemisphere, is enveloped in such a way in its fibrous capsule, that it will continue to be held by it unless the capsule be divided near the edge of the socket. The circumference of its transverse plane, upon which the axis of the neck of the femur falls obliquely outward, downward, and backward, having to be traced round with the knife at the moment of the operation, should never be lost sight of. The position of the internal ligament is such that, by turning the limb outwards, it presents itself at once to the edge of the knife. If the operation be commenced on the external side of the articulation, it is true that this ligament becomes relaxed in proportion as the thigh is inclined inwards; but as it in no wise prevents the luxation, it is very easily divided on the inner edge of the cavity.

Covered by the psoas and iliacus muscles, a little on the outside by the rectus internus, by the pectineus, the vessels and nerves on the inside, the coxo-femoral articulation is more superficial before than in any other direction, and corresponds to the junction of the middle with the external third of Poupart's ligament. Behind, it is separated from the skin by a considerable space, which is filled by the third abductor, the quadratus femoris, semitendinosus, semimembranosus, biceps, the obturators, the gemini, and pyriformis muscles, of the cellular tissue, the great sciatic nerve, and some vessels. A triangular space, filled by the gluteal muscles and *facia lata*, limited by the great trochanter below, and by the external iliac fossa above, removes its external side from the skin, whilst the great trochanter itself is almost naked beneath

the integuments. Internally there is found a kind of gorge or hollow, formed by the concavity of the neck of the femur, which descends as low as the lesser trochanter, filled by the principal mass of the abductors, the gracilis, the end of the psoas and ilacus, and which obliges us to seek the capsule on a plane much nearer the symphysis pubis, and much higher than the axis of the member would seem to indicate.

The lines drawn from the anterior-superior spinous process of the ileum, from the great trochanter or spine of the pubis, to measure the distance which separates these different points of the articulation, and upon which M. Lisfranc especially insists, should not be neglected in an embarrassing case; but the preceding indications will generally suffice for a surgical anatomist. The great and little trochanters, and even the head of the femur, continuing cartilaginous until the tenth or fifteenth year of age, may if necessary be divided by the knife, if there be any difficulty in turning their prominences in such young subjects. The anomalies presented by the cotyloid cavity, the tuberosity of the ischium or the neck of the femur, and the projections near its base, regard only the length, projection, or inclination of these different objects; so that they rarely cause any real difficulties at the moment of disarticulation.

§ 1. *Manual.*

A. *Circular Method.*—1. *English Process.*—Abernethy appears to have been the first to think that the amputation of the thigh in the articulation could be performed by the circular method. This surgeon compresses the artery on the body of the pubis; divides first the skin and then the muscles at some inches below the joint; separates the flesh from the great and little trochanter; opens the capsule; divides the inter-articular ligament; dislocates the bone; ties the different arteries, and concludes by uniting the lips of the wound antero-posteriorly with adhesive plaster, to maintain them in contact. Mr. Colles is not the only one who has practised Mr. Abernethy's method upon the living subject. M. Krimer has also followed it. Dr. Weitch, who also prefers it, exposes the femur before seeking the articulation for two or three inches downward, below the incision of the soft parts, in order to use it afterward as a lever to disengage it from its cavity; a useless precaution, for it is always possible to move the member with sufficient force in any direction after dividing the capsule.

2. *Process of M. Græfe.*—The circular method is equally praised by M. Græfe, who also applies it to almost all disarticulations, and claims the honor of its invention. At the thigh, as at the shoulder, he makes use of his large knife to divide the flesh, and penetrates from below upward from the skin to the head of the bone, in such a manner as to scoop out a hollow cone as regularly as possible. Having remarked that the head of the femur is sometimes difficult of dislocation, M. Græfe recommends the incision of the cotyloid cartilage upon the notch of the same name; but if the operator takes care to divide the fibrous capsule exactly over the largest circle of the joint, there will be no danger of the inconvenience that he apprehends, and which, according to S. Cooper, detained a celebrated operator of London nearly half an hour in the disarticulation of the thigh.

B. *Flap Operation.*—The method by the flaps has almost always been pre-

ferred for this amputation. A variety of different methods have been invented. I shall not speak of those of Ravaton, Moublet, or of Petit Radel, because they are too difficult or too complicated. Barbet, Perrault, and M. Baffos, having as it were only finished what nature had begun, do not present us with a process to be described.

1. *Process of Lalouette.*—In a thesis sustained under the Presidency of Lalouette, we find indicated one of the best processes that can be followed. It should be commenced, says Louis, who reproduced it, by a section almost semicircular at the external part of the thigh, in order to disarticulate the femur before any thing else, and then to finish by an incision of the internal part, preserving a flap of four or five fingers' breadth. The candidate M. de Vallun, described it as follows: the artery is compressed with a tourniquet; the patient placed upon the healthy side, the operator makes a semicircular incision, commencing over the great trochanter, ending at the tuber of the ischium, and penetrating to the articulation. With a second cut he opens the capsule, whilst the assistant carries the member inward; luxates the femur; divides the rest of the capsule, and terminates by making a greater or smaller internal flap, adapted to the *embonpoint* of the patient. M. Lenoir, assistant anatomist to the faculty of Paris, who has recently reintroduced this practice, employs an assistant to compress the artery, who compresses it in the flap with the thumb as soon as the incision is completed. The rest of his description is so exactly similar to that of Vallun and Louis, that I think it useless here to repeat it.

2. *Process of M. Plantade.*—Many persons have thought that it would be better to place the flap altogether in front, than upon the inner side of the thigh. M. Plantade, who was one of the first to suggest it, recommends the making of three incisions after the manner of the scapulo-humeral flap of de la Faye, opening the articulation by its internal face, and finish by forming a very small posterior flap.

3. *Process of M. Manec.*—In April, 1831, M. Manec showed me, on a dead subject, a modification of the method of M. Plantade. The knife, placed upon the centre of the space that separates the iliac spine from the great trochanter, is carried downwards and inwards, between the flesh and the anterior internal face of the neck of the femur, so as to pass out before the ischium, and at once form a large flap, the free edge of which presents in a semilunar form downwards and outwards. The assistant immediately seizes this flap and elevates it, taking care to compress the artery, if the operator should not prefer to tie it before proceeding further. To conclude, M. Manec divides the external and posterior soft parts, by means of the semicircular incison of Moublet, before disarticulation, or he first opens the joint, and make this incision last. M. Lenoir, who also praised this method, recommends, and I think correctly, that after the formation of the flap we should always finish the division of the soft parts, as in performing the circular operation, before proceeding to the disarticulation.

4. *Process of Dr. Ashmead.*—A distinguished young surgeon of Philadelphia, Dr. Ashmead, also imparted to me in the month of April, 1831, a process founded upon the same ideas as the preceding. Like M. Manec, he gives his flap a semilunar form. Like M. Plantade, he cuts from the skin towards the deeper parts. After dividing the integuments at the point indicated, he

seeks the artery, and ties it. Relieved from the apprehension of hemorrhage, he proceeds to the section of the muscles; having reached the capsule, he disarticulates the femur, and finishes like Plantade or Manec.

5. *Process of M. Delpech.*—M. Delpech's manner of operating, is one which gives a result almost exactly similar to that of Lalouette. This professor ties the femoral artery at its escape from under the crural arch; then makes an inner flap, by plunging the knife at once from before backwards between the *neck* of the femur and the soft parts, and bringing it downwards in the direction of the skin, with greater or less rapidity. The flap thus formed, is seized and elevated by an assistant. The operator makes a semilunar incision at the base; reaches the inner side of the articulation; divides the capsule and inter-articular ligament; brings back the thigh to its natural position; makes a semicircular incision below the external iliac region, and thus unites the anterior and posterior extremities of the flap; divides the three glutei, the obturator internus, the pyriformis, and the gemini muscles, and the external face of the capsule. The tying of the arteries and dressing, concludes the operation. M. Delpech insists, that with a single flap immediate union is more easy and sure. Slight pressure, he says, obliges the flesh to mould itself to the cotyloid cavity, thus preventing inflammation, suppuration, exfoliation of the cartilage, and fistulas. Moreover, as the flap presents a very oblique cut, he recommends that the section of the integuments towards the outside should be made a little higher than that of the other parts, in order that there may not be too much skin, and that the coaptation, which he aids by means of a suture, may be more perfect.

6. *Process of M. Larrey.*—Le Febure, who wrote to Louis, in 1760, to announce to him the result of his researches, had conceived the idea of tying the femoral artery in the groin. M. Larry has given this as a precept, which permits the surgeon, he says, to act with more security, and causes the patient to run much less risk. The artery being tied, the operator, placed on the outside of the member, passes the point of a long knife at two or three fingers' breath below, and inside of the anterior-superior spine of the ileum, so as to fall upon the anterior face of the bone; inclines it a little inwards, and slides it upon the internal face of the neck of the femur, and thus conducts it backwards, until it again passes through the skin in the sub-ischiatic groove; cuts an internal flap about four inches long, in the same manner as M. Delpech; causes this flap to be elevated; divides the capsule for half its circumference at least very near the cotyloid cavity, as if he would cut through the middle of the head of the femur, without attempting to enter the articulation; abducts the member; divides the internal ligament; passes the knife about the external side of the sphere of articulation; finishes the section of the capsule; arrives at the tendons of the glutei behind the great trochanter; inclines the knife flatwise, by directing its edge downwards; grazes the external face of the body of the bone, and forms a second flap as much as possible like the first. All the arteries being tied, the two flaps are brought together, taking care to leave the ligatures in the posterior angle of the wound to serve as a conduit to the matter formed.

7. *Process of M. Blandin.*—It appears that the double flap method had been a long time in use when Larrey made his publication, in 1803. That of M. Blandin, a method that this operator had used as early as 1795, consists

in first tying the artery, and then making the first flap like Mr. Larrey; but instead of continuing from within outward, like the latter, M. Blandin makes his external flap before touching the capsule and proceeding to the disarticulation.

8. *Process of M. Lisfranc.*—M. Lisfranc makes use of a narrow two-edged knife; plunges it from before backwards on the outside of the neck of the femur, turns about the great trochanter, and thus begins by forming a flap three or four inches long; placing his instrument again at the superior angle of this incision, he inclines the point a little inwards, to glide over the neck of the bone; immediately elevates the handle; draws the flesh inwards, so that the knife may pass out under the ischium without again touching the integuments; divides all the tissues (without leaving the os-femoris), as far as the lesser trochanter; turns this osseous process; directs an assistant to embrace the origin of this second flap, by thrusting his thumb into the wound and thus compressing the artery, and terminates the section of the internal soft parts, as M. Larrey does; ties all the vessels, and then disarticulates the limb.

9. *Process of M. Dupuytren.*—The surgeon places himself on the inside of the limb, and uses, if ambidexter, the right hand for the right, and the left hand for the left side; has the integuments drawn towards the pelvis; supports the thigh himself, inclining it more or less towards flexion, extension, or abduction; makes on the inside a semilunar incision with downward convexity, commencing near the anterior superior spine of the ileum and ending near the tuber of the ischium; divides at first only the skin, which an assistant then retracts; immediately divides the muscles in the same way, thus forming an internal flap four or five inches long; causes this to be elevated; attacks the capsule, like M. Larrey; passes through the articulation, and finishes with an external flap.

10. *Process of Beclard.*—Placed on the outside of the hip, Beclard began by cutting an external and posterior flap, by thrusting his knife obliquely inward and backward, from near the iliac tubercle to the internal extremity of the sub-ischiatic notch, and touching the posterior sides of the neck of the femur. A second flap must be formed in the same manner before, in order to finish by the section of the capsule and disarticulation. Dupuytren and Beclard content themselves with the compression of the artery on the horizontal branch of the pubis.

11. *Process of Mr. Guthrie.*—Two semilunar incisions, one antero-internal, the other postero-external, extending from near the iliac spine to near the tuberosity of the ischium, where they meet, characterize Mr. Guthrie's method. This surgeon first divides the integuments; raises them; carries the instrument to the edge of the retracted skin, and divides the muscles obliquely upwards; reaches thus the articulation after making two flaps, and terminates, like MM. A. Blandin, Abernethy, Lisfranc, and Beclard. It is evident that the English surgeon's method differs from that of Beclard only in dividing the tissues from the skin towards, instead of the reverse; but it is in this very difference that we find its real advantages.

C. *Oval Operation.*—The oval operation has not yet been applied on living man, for the amputation of the thigh at the articulation. The two varieties that it presents, were tried upon the dead subject, by MM. Cornuau and Scoutetten first, and afterwards by all the young surgeons who practised the manual of operations in the amphitheatres.

1. *Process of M. Cornuau.*—The patient is laid upon the healthy side. The surgeon, placed behind the hip, makes the first oblique incision, which commences above the great trochanter, and must be carried from behind outward, and downward to below the ischium; makes another similar incision before and inward; then a second cut for each incision, to divide the muscles as deeply as possible; he then attacks the articulation at its external face at the same time that the member is abducted by an assistant: passes through the articulation inwardly as soon as the head of the femur is dislocated. In fine, whilst a second assistant raises the two flaps, he divides the interosseous ligament, the inner part of the capsule, and all the soft parts that separate the inner extremities of the two first incisions, or form the base of the V.

2. *Process of M. Scoutetten.*—The operator first sinks the point of the knife above the great trochanter; then depresses the handle gradually, to divide all the tissues as before; commences again at the posterior extremity of the first incision, and passes over the other side of the member, to unite it with the summit of the first. If there remain any soft parts between the internal posterior part of the neck of the femur and the integuments, the operator divides them, and finishes by disarticulation.

§ 2. *Relative Value of the Various Methods.*

Of these numerous methods, I can only repeat what I have said of the amputation of the shoulder. Almost all are applicable in practice. No one should be exclusively adopted. Yet as many of them are mere modifications of others, they may be rejected without inconvenience. In the circular method, for instance, which is certainly the least advantageous, and which should be selected only in case the disorganization of the integuments extends over every part of the circumference of the member to very near the hip, Abernethy's method, and that of Græfe, differ only in this, that that of the German surgeon admits of a more easy reunion of the lips of the wound than the other. The modification of Mr. Weitch has no other value than as it permits the operator to remove the fractured member first, and then to proceed with the disarticulation of the superior fragment by another incision. A precaution that I would not fail to take would be, to dissect and evert carefully all the healthy skin, in order to divide the muscles very high, and to remove as much of them as possible.

The oval operation is appropriate wherever that of the double flap seems applicable. It makes a wound almost as regular as the circular, presents no obstacle to immediate reunion, and exactly fills the cotyloid cavity. Of the two aspects that it has been made to present, one has scarcely any advantage over the other. I would only recommend that the cutaneous envelope should be divided lower, and the muscles higher than has been prescribed. The bringing together of the lips of the wound will be thus rendered more easy, whilst the inflammation, reaction, and suppuration, will manifest themselves with less intensity.

Among the flap operations, the double ones are somewhat indispensable, when it is possible to give them the same length, and when the soft parts are equally altered in all directions. Then Dupuytren and Guthrie's are superior to the others, because they permit us to save more skin than muscle; and also because the flap, being placed obliquely and not on each side, as in Blandin's,

Larrey's and Lisfranc's, more easily fill up the cavity formerly filled by the head and neck of the femur with the great trochanter.

When an external flap is formed after the manner of Larrey, it is rare that it does not present a slope on its inferior edge, or that it corresponds in thickness with the internal one.

The single flap operation should be preferred, if the soft parts of one side be diseased when those of the other side are not. In such case the nature of the disease indicates in what direction to preserve the flap, which should not be outside nor behind if it can be avoided. Inwards and anteriorly I prefer Lalouette's to Delpech's method, and still more one of the modifications recently proposed. As M. Lenoir performs it, Lalouette's method gives a flap much more regular than that of the professor of Montpeliers; but this flap is too thick, and not sufficiently large. By cutting from the exterior inwardly, as Mr. Ashmead does, the operator is more sure of what he does; the ligature of the artery may be neglected, and he saves more of the integuments than of the muscles. It was thus that I operated on the patient of whom I have spoken. After raising the skin for three inches before and within, and making a semicircular incision outwards above the great trochanter, I went on to the division of the flesh and the disarticulation from the front, without stopping for the artery, which an assistant compressed upon the crest of the pubis: the operation occupied but half a minute. The previous tying of the femoral artery, recommended by Lefebure, Moublet, M. A. Blandin, and M. Brulator, adopted by MM. Larrey, Delpech, Orthon, and Roux, and rejected by Abernethy, Baffos, Guthrie, &c., is, as has been said, one operation more added to the primary one; yet if in the flap operation, compression over the pubis or with the fingers in the flap, as it may be effected, in executing the method of Lalouette, Lisfranc, or Delpech, and even the oval method, should not give all the security desirable, it is so easy to discover the femoral artery under Poupart's ligament, that it is best to do so, unless it be thought preferable to adopt the proposition of Mr. Ashmead.

Unless the patient be very weak, or the operation occupy considerable time, I cannot see the necessity, or even the utility of tying the arteries before disarticulation. The fingers of a skillful assistant applied upon these as they are divided, permit us, as I have satisfied myself, to wait until after the removal of the limb. These arteries are, the obturator within, the ischiatic without and behind, then before and without, some branches of the gluteal or of the internal pudic: it is also necessary, even if the ligature should have been applied before the operation, to again tie the femoral artery at the bleeding surface, as well as the deep-seated muscular, in order to produce immediate union of the little wound which had been first made.

The necessity of bringing in contact as much as possible the two sides of the enormous wound which is left by the disarticulation of the thigh, is not contested by any person. The suppuration of so large a surface would soon destroy the patient, from exhaustion, and would never fail of being attended with the most violent general reaction. The suture, which M. Delpech much applauds, has been often applied, and it must be confessed that it is one of the cases in which its employment seems most justifiable. It is not to be applied without pain, it is true; but if it be useful, should a little more or less suffering be allowed to rob us of its advantages? I would remark, however, that it is

not the integuments, but the deeper tissues that it is so especially important to bring together; and that by using the suture, it is to be feared that the matter formed, if it accumulate at the bottom of the wound, may produce serious injury before it can escape. The adhesive plasters, which have the advantage of not impeding the discharge, also permit us after some days to approximate the edges of the wound more exactly than at first, if the base of the flaps appear to unite properly. Without absolutely rejecting the suture, which seems to be gaining favor at this time in the south of France, I believe that we may, and that we should dispense with it in this operation except in some particular cases, which the intelligent surgeon will always be able to distinguish.

TITLE III.—EXCISION OF THE BONES.

Practised from the time of Galen for certain bones of the trunk, and to all appearance for some of the articular heads, excision of the bone has only been used, according to fixed rules, for about half a century. It is performed in the continuity, or at the extremity of the bone, and is always used to avoid amputation of the limb.

CHAPTER I.

In the Continuity.

In the continuity of the bone excision is rendered necessary, either by recent complicated fractures, old fractures not consolidated, caries, necrosis, osteo-sarcoma, spina-ventosa, or by any other incurable organic disease.

1st. *Recent Fractures.*—When in a fracture the extremity of one of the fragments escapes and projects through the torn integuments, if suitable extension of the opening and well-directed efforts fail to replace the parts, the excision of the projecting portion of the bone has been always recommended and practised. The operation is very simple. Two assistants lay hold, one of the upper, the other of the lower portion of the limb, to increase its curvature, and make the osseous points project still more. The operator extends the wound if necessary, protects the flesh by means of a fold of linen or a piece of pasteboard, and divides the denuded bone, either with an ordinary saw, or some instrument appropriate to the form and position of the part. It is to the tibia, fibula, the bones of the fore-arm, and some of the phalanges

that this kind of excision has been most frequently applied; the principles of which it is almost impossible to lay down.

2d. *Wounds from Fire-arms.*—In the sequence of wounds by fire-arms, when the principal bone or bones of the member have been fractured and reduced to splinters, whilst the soft parts adjoining have not been too much injured, instead of amputating, it was early thought an advisable course to extract the detached bony pieces, and then to project the angular fragments of the two ends of the bone for excision. In this case the surgeon is almost always forced to augment the original wound, or even to make a new one. The tissues are commonly divided in the direction of the axis of the limb, at some point distant from the vessels and nerves. By this incision the two ends of the bone are made successively to escape. After having isolated them properly, the surgeon dissects away the points and all the parts that may affect the cure; and conducts himself otherwise as in the preceding case.

3. *Old Non-consolidated Fractures.*—After certain fractures consolidation does not take place. The two ends become rounded, and form in the continuity of the member an abnormal fracture, that injures or almost entirely destroys its functions. To remedy this accident, some authors have proposed the injunction of perfect rest, and the employment of certain machines for a long time. Others have thought it better to pass a seton through this species of morbid articulation. Some content themselves with rubbing the osseous fragments against each other to produce inflammation. M. Somme has recently passed a silver wire around the intermediary substance, to produce an insensible division of it. M. Harsthrom has not been less successful in destroying it, by applying caustic potass upon the two extremities of the fragments. But in such cases rescission is a means that offers evidently more chances of success. White, of Manchester, who attempted it once in 1760, for a non-consolidated fracture of the humerus, the two extremities of which he sawed after having brought them out, and at another time on the tibia, cutting off only the superior fragment, completely cured both subjects. M. Viguerie and Langenbeck imitated him with the same happy results, for fractures of the fore-arm. M Dupuytren, who from choice only excises the upper portion, contents himself with rasping the other. M. Rowlans, M. Pezerat, &c., have also performed this resection with success, for non-consolidated fractures of the thigh. Messrs Larrey, Boyer, Richerand, Physic, &c. cite some cases, which were followed by serious accidents, and even death. So that it should not be decided upon until after mature reflection, and after its necessity is well established; the more so as the disease sometimes becomes a supportable infirmity. An example is found in a thesis of M. Carron of a man labouring under one of these fractures of the thigh, and who walked very well without crutches. In a case of M. Kulnholtz there was a complete false articulation, which scarcely affected the functions of the limb. M. Cloquet speaks of a patient in whom the superior fourth of the humerus had been for a long time destroyed, without preventing the movements of the arm. M. Yvan says the same of the femur. The double gutter of tin, contrived by the artist Baillif, enabled the three individuals mentioned by Trochel to walk with ease. I have myself seen at the central bureau, a woman who had one of these fractures of the right thigh, and who travelled without crutches by the aid of a very coarse machine.

The Method of Operating is, as to the rest, nearly the same as for fractures

with external laceration; presenting only this difference, that the division of the tissues must always be made at the point most favorable to the eversion of the end of the bone, and where it will cause the least danger, whilst in the other case it is frequently sufficient to prolong more or less the existing opening in this or that direction, and in a way which it is here unnecessary to indicate. The two fragments are made to present, one after the other, at the incision; when, after detaching the adhesions and protecting the flesh and skin, division is made of the non-consolidated ends of the bone.

Whether the excision has been performed for a recent fracture, with or without displacement, or for an ancient fracture, the subsequent treatment and dressings are in both cases nearly the same. In every case the limb must be restored to its natural shape, the bone sunk into its place again, and retained there after the reduction. The incision should be filled with charpie or lint, and if necessary covered with a perforated bandage. If it appear possible to escape suppuration, immediate union should be attempted by the assistance of some pieces of agaric and graduated compresses, or by the suture and appropriate dressings. The whole is to be maintained by Scultet's bandage, cushions filled with straw, or even splints, when it is not possible to prevent movement of the limb without them.

Organic Lesions.—Excision for caries, necrosis, &c. although less frequently practised than that of which we have just spoken, is nevertheless very often indicated. Except the observations of Tenon, who did not hesitate to remove the great trochanter; those of Moreau, who, in 1793, excised a considerable portion of the tibia; of Percy and Laurent, who are said to have removed eight or ten inches of this bone with the saw and trepan, and to have removed the whole of the fibula for a caries, or rather, no doubt, for necrosis of the leg; of Beclard, who in conformity to the advice of Desault, dared also to excise the superior third of the fibula for a spina-ventosa; of Hey, who in his work reports many cases of the excision of the bones of the leg and arm; of M. Couty de la Pommeraie, who has lately published a case of abscission of almost the whole extent of the humerus, surgeons scarcely mention this kind of operation, which, however, has been very recently practised at the *Hopital, Beaujon,* with entire success for a very extended necrosis of the tibia. The surgeon being obliged to conform to circumstances, to vary the operation in accordance with the preservation or loss of the natural form of the member, with the extent or seat of the disease, lays the bone bare by means of simple longitudinal incisions, or when absolutely necessary, by making at the expense of the soft parts one or more flaps of suitable size and form. When the disease is exposed, the saw or the trepan is to be applied, or in other cases the gouge and mallet: the saw, when the bone is cylindrical or not voluminous; the trepan, when the bone is large and difficult to isolate, when very thick, or, in fine, when the neighbouring parts will not permit the use of the saw; the chisel, when only some laminæ, a part of the thickness of the affected bone, are to be removed. Incisive nippers may also be used, or indeed any other instrument that an intelligent operator may contrive. M. Seutin, of Bruxelles, who with remarkable success extracted almost the entire fibula, used a trepan to separate the superior extremity, and divided the lower with a curbed saw. It is here that the flexible or chain saw, are particularly indicated.

Not only can the abscission of the central portion of the limbs be thus

effected, but it may also be practised upon the trunk, the cranium, the sternum, the ribs, the clavicle, the vertebræ, &c.

Art. 1.—*The Ribs.*

Among the excisions of the bones of the trunk, there is one that has more especially fixed the attention of the moderns: I speak of the abscission of the ribs, which is said to have been performed by Galen, Aymard, Sedillier, Lecat, Ferrand, &c., and which the Indians are said to have often used, and to which they gave a particular name. The old *Journal Encyclopedique*, contains an example, the knowledge of which I owe to M. Dezemesis. Suif excised two ribs from a man named Botaque, so that he could pass his fist into the chest. An affected portion of the lungs was removed, and the patient cured. Yet it was scarcely thought of, when, in 1818, M. Richerand performed it upon a person affected with cancer of the thorax. Since then it is known that Dr. Celadini has performed it twice successfully in Italy. Percy and Laurent are said to have tried it with like success, and recently the journals inform us of its having been attempted at the *Hopital Beaujon*, at *La Charite*, and in America, by Dr. Mott. M. Richerand's case is, without doubt, the most remarkable of all. It was necessary to remove the central portion of four ribs for several inches in extent. The pleura, being much thickened, and having passed into the lardaceous state, had to be also destroyed; so that the pulsations of the heart were plainly seen, that organ being enveloped in the pericardium. The result of this beautiful operation was at first most satisfactory; but after some months, and before the complete cicatrization of the wound, the cancer again appeared, and terminated the existence of the patient.

Operation.—After exposing the rib or ribs to be excised, after having extended the incisions as far as the disease in each direction, either a saw in the form of a cock's comb, or the chisel and mallet, or simply that kind of shears employed in the amphitheatres, known by the name of *secateur*, may be used, commencing at one or the other end, and finishing at the opposite extremity of the rib. It is necessary to preserve as much as possible of the pleura, which all operators have remarked is then sensibly thickened. If, however, it be too deeply affected, and especially if it be the seat of a cancerous degeneration, it should be destroyed without hesitation.

Art. 2.—*Sternum.*

Galen had the boldness to lay bare the greater part of the sternum, and isolate it by means of a trepan and gouge, and remove the whole diseased portion, so as, like Richerand, to expose the heart to the eyes of the assistants. The same course must be pursued at the present time, when it has been decided upon to follow the precepts of the physician of Pergamos; a course that has been followed in the last century by Sedillier de Laval.

The excision of the crest of the ileum, attempted by Leaulte; that of the os calcis, two cases of which are reported by Hey and Roux, and which I have myself performed; of the spinous processes of the vertebræ, which M. Jules Cloquet recommends, and which Dr. A. G. Smith used with success on a

patient laboring under paraplegia for two years; of every bone, in fine, that naturally projects beneath the skin, cannot be a very difficult nor even delicate operation; but as the form of the disease and its extent always produces great modifications in the operation, I cannot enter into more lengthened details upon the subject.

Art. 3.—*Lower Inferior Jaw.*

History and Value.—Wounds from fire-arms, accompanied by comminuted fracture, have long proved that considerable portions of the lower jaw may be destroyed without producing death. Caries and necrosis have also often caused the destruction of this bone; and yet those thus affected have commonly recovered, even without any very great deformity. Hippocrates gives an example. One of the most remarkable was that observed by Guernery; the jaw entirely exfoliated, but was so far reproduced as to permit mastication! V. Wy speaks of a patient who lost the whole, either spontaneously or by the aid of art. Two such cases are met with in Desault's journal. Chopart and Louis have also extracted it successfully. Walker says he was obliged to remove the two branches and a part of the body in a negro, who afterwards recovered the power of masticating. A woman, observed at Bourges by Rugger, had lost the right half. Boyer reports, in the *Bibliotheque de Planque*, the case of a patient who had it carried away by a mill-wheel, and recovered. Wepfer cites a case in which the amputation of the side of the jaw had been successfully made in his time. In fine, M. Larrey speaks of a soldier who had had the jaw almost entirely destroyed by a gun-shot, but who still lives. In fact, many subjects may be seen at the *Invalides* with traces of similar mutilations.

Yet observations of this kind remained without application, when in 1812, M. Dupuytren resolved to amputate almost the whole body of a cancerous lower jaw by a new method, to which the title of a surgical triumph has been given. Since then the same operation has been repeated a great number of times by the same professor; and also in Germany, England, America, and France, by Mott, Richerand, Lallemand, Delpech, Roux, Casack, Martin, Gerdy, Magendie, Cloquet, Wardrop, Lisfranc, Warren, Gensoul, Græfe, Walther, Wagner, Randolph, and myself. It is not only to necrosis that it may be applied, but also, and especially to cancers and all organic affections that will not yield to any thing else than the removal of the parts that are their seat. If it should appear to make success doubtful to go beyond the first molar teeth, because the attachments of the genio-glossus and geneo-hyoideus, of the mylo-hyoideus and digastricus muscles being destroyed, the tongue, acted upon by the glosso-pharyngeus, must be apparently drawn back and fill the pharynx, and thereby endanger suffocation, it should be known that experience has confirmed these fears only in part. M. Dupuytren has gone beyond the first molar teeth. In M. Richerand's patient, the whole body of the bone was removed. I have twice performed this operation, and each time went to the canine teeth. After the dressing no precaution was taken to fix the tongue anteriorly, and yet there resulted no unpleasant symptom. M. Walther and M. Græfe, according to Dr. Pattison, then Dr. M'Clellan, have removed almost the whole bone, and cured their patients. If the disease be situated more on one side than on the other, then it is possible to leave untouched the opposite half of

the organ, removing only that which is altered. It was thus that Mott, J. Cloquet, Lisfranc, Blanchet, Roux, &c., did; in this case the inconvenience in question is not at all to be apprehended.

It is certain, on the contrary, that in other cases the tongue is carried with great force backwards and upwards, as soon as its anterior attachments are divided. M. Dupuytren always warned his auditors of this, and M. Delpech, who made it the subject of some interesting remarks, even thought of remedying it, by passing a golden wire through the organ near the frænum, for the purpose of fixing it to the teeth nearest to the extremity of the remaining fragments of the bone.

Operation.

A. *Body of the Jaw.*—When the disease is confined to the chin, the operation is generally very easy and simple. In this case there are two methods of operating. If all the soft parts are healthy, they are divided upon the median line from above downward, from the free edge of the lip to the thyroid cartilage, and the two flaps, thus formed, dissected and everted. In the other case, two incisions uniting over the larynx, should form a V, or triangle, comprising within its limits the whole disease.

The apparatus consists in needles, ligatures as for hare-lip, a chafing-dish of fire, cauteries, and all other things necessary in amputation and dissections of the most delicate nature. Three assistants at least are necessary.

First Step.—The patient may be seated on a chair or a bed, moderately elevated. An assistant placed behind, turns back the head with one hand, and lays hold of the angle or right side of the lip with the other, at the moment the surgeon commences the incision. The latter, with the first two fingers of the left hand, takes hold of the edge of the lip on the other side, whilst with the right hand armed with a bistoury, he makes the incision; and then successively dissects away the two sides of the wound as far as may be necessary around the disease, taking care to commence with the right side. Having done this, he separates the muscles and other soft parts that adhere to the edges and internal face of the bone, carefully avoiding the insertion of the genio-glossal muscles. The operator may, as some person recommends, reserve this part of the operation for the end, and saw the bone before dissecting it away. An ordinary saw will serve the purpose. A tooth on each side of the confines of the disease should be removed, if they have not already fallen out, and if they seem likely to interfere with the action of the instrument. The operator, holding with one hand the anterior portion of the affected mass, applies the thumb a little behind it upon the healthy portion of the bone (which should also be fixed behind at the angle by an assistant), in order to direct the action of the saw, which should pass as nearly as possible between two alveoli and from above downward, or *vice versa*, as it may be most convenient. This first division having been accomplished, the assistant takes hold of the diseased tissues, whilst the surgeon passes his hand behind them. A second passage of the saw terminates the section of the bone, which in order to be removed must be depressed; whilst the other assistants, separate, retract, and protect carefully the soft parts of the neck and face. It then remains only to detach the deceased fragment from the tissues within the mouth, by carrying a bistoury flatwise, and vertically upon the posterior face

of the chin. At the same instant, an assistant having the hand covered with a piece of linen, seizes the tongue by its point and draws it outward, thus preventing the symptoms of suffocation, and permitting the surgeon to pass a cautery, heated to whiteness, over the whole extent of the wound, or at least wherever any arterial branch is likely to be found.

With two or three points of twisted suture the two lips of the wound may be united, the inferior angle of which, however, should remain open, and even filled with a tent, to allow free passage to the results of suppuration. Some strips of diachylon, some pledgets and compresses, and a bandage, complete the dressing. Some persons place several small pledgets of coarse charpie behind the tissues of the face, in order to fill up the vacuum between the two bony fragments.

Remarks.—When the loss of substance is not considerable, it is well to bring the fragments in contact, and fix them so by means of a wire passed around the anterior teeth, as M. Delpech has done. In the contrary case, this precaution will be at least useless. The ligature through the inferior face of the tongue, recommended by the professor of Montpelier, will only be necessary if this organ continues to be violently retracted towards the throat. Some persons find the bandage superfluous, and content themselves with the suture and compresses; the latter method gives the parts more freedom, and permits the surgeon constantly to watch the progress of the pathological phenomena. But this must all be left to the taste of the surgeon.

The sub-mental, sub-lingual, very rarely the ranine, the terminating branch of the inferior maxillary, and the coronary arteries of the lip, are almost the only vessels that the instrument encounters, and that require attention. Some of them, hid in the soft parts, are too difficult to find to admit of the ligature. It might be possible with cold water, or sponges soaked in vinegar, to arrest their bleeding, and thereby dispense with the heated iron. Yet, as M. Dupuytren uses the latter means constantly with success, prudence at least, if not necessity, justifies its application. The three last named arteries cease to bleed spontaneously, and scarcely ever require particular attention. In one case M. Græfe had a hemorrhage from the central artery of the bone. In this case a plug of wood or wax, like that which M. Magendie used, or a compress of any kind, at the point from which the blood escapes, should be employed, if the operator do not prefer to have recourse to the cautery. Lastly, instead of a simple incision, or two incisions united at their inferior extremities, it may be necessary, if the disease be extensive, to divide each lip of the incision transversly below the lower edge of the jaw.

B. *One of the Branches of the Jaw.*—When the amputation need comprehend only one of the sides of the inferior maxillary bone, the operation is not altogether the same as that just described.

1. M. J. Cloquet began with the vertical incision above described; then made a second, extending from the commissure of the lips to a point above and behind the angle of the jaw; then dissected and turned outward and downward the very large flap of the soft parts thus described; detached the tongue from the internal edge of the alveolar process, and ended with the section of the bone; cutting first anteriorly and then posteriorly at the origin of its ascending plate.

2. Dr. Mott operated in a manner a little different. He began by tying

the carotid artery of the diseased side, and then proceeded to the amputation of the bone. The first incision began at the ear on a line with the condyle, and extended in a semilunar form with its convexity backwards to near the chin, and below the labial commissure. The teguments, the inferior part of the masseter muscle, and the parotid gland, were then dissected away. A second incision, from the superior extremity of the first toward the anterior edge of the sterno-mastoideus muscle, passing below the ear, enabled the surgeon to expose the whole diseased part. With the aid of a small saw the jaw could be divided anteriorly on a line with one of the lateral incisor teeth. With another saw, smaller than the first, and made expressly for the case, Dr. Mott made a section of the ramus of the jaw immediately below its two upper apophyses, and was not able to remove the whole morbid mass, until after having carefully detached it from the internal pterygoid and mylo-hyoid muscles. In the latter part of the operation he properly directs the complete division of the inferior maxillary nerve, before exerting any traction upon the bone, and that it should not be forgotten that the lingual branch of the fifth pair is found in the neighborhood.

Remarks.—Whenever one of the sides of the jaw is amputated instead of the chin, the facial artery is necessarily divided at a greater or less distance from its termination. In M. J. Cloquet's operation it was divided at the time of the transverse incision, and again whilst detaching the flap; but the latter section may be, if necessary, avoided. By Dr. Mott's method we wound it inevitably whilst passing over the external face of the bone. When the affection does not reach beyond the maxillary angle, it is evident that the method of the French surgeon merits the preference. When, on the contrary, the alteration reaches very high up towards the temporo-maxillary articulation, by imitating the American professor we are more sure of exposing the whole disease, whilst at the same time we preserve the parotid gland and its duct. His method is equally adapted to disarticulation, if it should be preferable or necessary, as with the patient operated upon by M. Gensoul, and who died of a pleurisy the fourteenth day. Upon the whole each case must have its peculiar exigencies. It is for the surgeon to select or originate the most appropriate method, when any other than the middle part of the bone is to be amputated. The preparatory tying of the carotid, performed by Mott, Cusack, Walther, Græfe, and Gensoul, can be indispensable only in a small number of cases, and in them it must be because the saw acts transversely, as, for instance, very near the temporo-maxillary articulation; yet it is probable that even then it will often be possible to dispense with it. The temporal artery (opened once in England), the internal maxillary, the external carotid, and the inferior dental, which lie along or turn around the posterior edge and neck of the condyle, or are found within the maxillary branch, can be easily separated by a well-taught assistant, at the moment when, after having sawn the bone, the operator wishes to detach it behind from the tissues that adhere to its internal face. A ligature applied to them after the dissection, would also be another resource against any unhappy result, and the compression of the primitive carotid is too easy to leave room for any very great inquietude. When the tissues of the face are healthy, perhaps it would be better to imitate M. Roux in forming a large flap with a downward convexity, which may be dissected and everted from below upwards.

After filling the space that separates the two ends of the bone, with charpie, agaric, or sponge, the lips of the wound is to be united by the necessary number of needles and hare-lip sutures, as after amputating the chin.

After the Operation.—At the first annunciation of this operation, it was thought there would result from it a very great deformity, and an impossibility of executing mastication. It was a mistake. In the case of Lesier, the first patient operated upon by M. Dupuytren, almost the whole body of the bone was taken away, yet the loss is now scarcely perceptible. Others, since operated upon, are almost in the same situation, without excepting even M. Ehrmann, of Strasburg. Cellular matter soon shoots up between the bony fragments, becoming fibrous or cartilaginous, and ultimately acquiring so much solidity as almost to equal the bone that it replaces, the two remaining portions of which it firmly connects.

But it must be stated that M. Lallemand's patient was not so fortunate. In him the two ends of the bone remained movable, on which account he is obliged to use an artificial chin. But the loss of substance had been very considerable; which explains at the same time the danger caused at first by the retreat of the tongue—a danger at once removed by instantly performing tracheotomy. The wound may remain fistulous at its inferior angle, because of the passage of the saliva through it, and thereby cause the exhaustion of the patient. One of those I have operated upon was in this condition, when erysipelas carried him off the twenty-second day after the operation. I saw, in a case operated upon by M. Richerand, the tongue so much drawn back as not to permit the ingestion of aliments. Death occurred on the twenty-eighth day, and seemed the consequence of suffocation. Perhaps it was the same with the woman operated upon by Magendie, in 1830, at La Salpetriere, who died suddenly in the night. After the removal of one of the lateral portions of the jaw, the fixed point of the genio-glossal muscle being preserved, there is less danger of retraction of the tongue. In this case an obliquity in the projection of the chin, sometimes very decided, is almost inevitable. It took place in the patient operated upon at the *Hopital de Perfectionnement*, in 1826, and was also observed in the cases cited by Mott, Gensoul, Lisfranc, &c., To conclude, the amputation of the chin is a happy acquisition to modern surgery, and that of one of the sides of the bone, even when it is necessary to comprehend the articulation, appears to be an equally valuable resource in many cases; but it is difficult to comprehend how the entire removal of the whole bone can be successful in curing the disease, and yet preserve the faculty of deglutition. We know that as a consequence of its exfoliation, of which Snell, Gambini, and Bellemain, have reported some new examples, it may be otherwise. The dead part is not separated until the system has more or less completely prepared itself for its absence by the creation of a new tissue, that lessens very much the deformity. It is also known that the forcible extraction of the exfoliation, performed by M. Dupuytren, in 1830, is nothing else than an amputation properly so called, and that there can be no method given for the performance of this operation.

Art. 4.—*Superior Maxillary Bone.*

Encouraged by these successful cases, by some examples of the destruction of the sinus and some serious lesions of the superior jaw-bone, spontaneously

cured, M. Dupuytren immediately thought that the abscission of this bone might also be attempted. It besides appeared, that Acoluthus had performed it in 1693, for a tumor of the face, and cured his patient. Camper speaks of a subject who had lost the entire bone, and yet survived. Still, however, Bidloo and Desault, who had conceived the possibility of the operation, had gone only so far as to recommend it. These vague and unfixed notions it is evident detract nothing from the moderns in this question; a question which in itself really comprehends two—the excision and the disarticulation of the bone. M. Paillard affirms, and the bulletins of the faculty prove, that M. Dupuytren had recourse to the first of these operations, in 1819, and to the second, in 1824. M. Pillet, who insists that M. Gensoul is the only person who has yet performed the latter, says that the patient of M. Dupuytren, having died at La Salpetriere, it was found that a portion of the bone had been left.

It was in 1826 that M. Lizars, who also claims the priority, proposed it; he performed it in 1827, 28, and 30, with success. But it appears to me that all parties think too highly of the importance of this part of the question. The excision of some portions of the superior maxillary bone has been long ago performed; at the present time some have gone a little further: this is the whole affair. Even when the whole of the bone has been removed, a thing not easy to prove, the circumstance does not merit the title of an invention. This debate then is not worth the pains that have been bestowed upon it. M. Dupuytren has in certain cases made the excision of the alveolar edge by means of nippers or cutting forceps, or the chisel and mallet; in other cases he has made incisions on the face, in order to remove the osteo-sarcoma more surely, and many of his patients thus treated have done very well. M. Gensoul's case, it is said, has completely recovered; although, as M. Pillet says, the palate bone itself was entirely extracted. Mr. Lyme, who attempted it in the early part of 1829, for cancerous tumor of considerable size, made a crucial incision, one of the branches of which extended to the corresponding commissure of the lips, dissected and everted the flaps, and destroyed the tumor by means of a cock's-comb saw, a chisel, and a very strong scalpel. Some months after, the appearance of some vegetations awakened apprehensions of a reappearance of the disease. The three instances of success, which occurred to M. Lizars, having been obtained with different diseases, and by different processes, cannot serve for the foundation of any particular method. M. Gensoul says, that although he removed the maxillary, malar, and palatine bones four times; that although he has four times extracted, and many times excised the first named bone; and that although in one case he took away the pterygoid apophysis itself to its base, he has been always successful, and always cured his patient. But as he does not give us the process he followed, I am forced to pass over his experience in silence. M. Lisfranc exposed a facial tumor by means of an incision in form of a V; divided the naso-palatine partition with the large scissors of M. Colombat, and finished with the chisel and mallet. In 1823, Dr. A. H. Stevens used, in a similar case, a flexible saw, passed by puncture through the bone; and Dr. Rogers, of New York, who, in 1824, removed the bone on each side as far as the pterygoid apophysis, had scarcely any occasion to divide the lip. It is also necessary to add to the other example that mentioned by M. Piedagnel, as occurring during

the service of M. Bauchine, in 1818, and that which M. Lafont has just communicated to the academy.

I have also had occasion to practise the excision of the upper jaw upon a female, aged forty-five years. All the molar teeth of the left side had been destroyed or extracted. An opening capable of receiving the end of the finger, permitted me to explore with ease the interior of the sinus, the surface of which was covered with bleeding vegetations. Its edges, equally fungous, were hard and lardaceous, and blended with the surrounding tissues. Many portions of the exfoliated bone belonging to its external and anterior walls, were seen in the midst of the diseased mass, which extended backwards to the palatine arch, and forward to the incisor teeth, and inwards to the median line. The operation was performed early in July, 1829, at the hospital *Saint Antoine.* One incision commenced at the commissure of the lips, and being carried obliquely upward, outward, and backward, to the temporal fossa, between the external angle of the eye and the pavilion of the ear, enabled me to avoid the parotid duct, and after dissection to raise up a triangular flap, comprising all the soft parts that covered the cheek bone and the canine fossa. With a saw, applied immediately below the orbit, I divided the projecting part of the malar bone, and penetrated into the sinus; with a very strong scalpel I then cut the maxillary bone in front, after extracting one of the incisor teeth, so as to unite the second section with the first; at a third stroke I prolonged the incision of the hard parts to the molar tuberosity. All the lardaceous tissue, a great part of the necrosed bone, and the whole facial walls of the sinus, were thus cut away. With the point of the same instrument, I divided, through the mouth, a horizontal portion of the palatine arch, parallel to the median line. I then scraped the floor of the orbit, and made use of the dissecting forceps to extract many scales that had been left, that belonged to the palate bone, the posterior walls of the sinus, or the cavity of the orbit. It was necessary to penetrate in one direction into the zygomatic fossa, and in another into the orbit. It was evident that the bone that separated these last two cavities had been destroyed; for the finger, when carried to the bottom of the sore, pushed the eye upward under the superior eye-lid.

Fearing that some of the diseased parts might have escaped me, I passed the actual cautery over the whole extent of this large excavation. After filling the wound with charpie, I united its lips by means of the twisted suture, supported by a simple bandage. The local and general symptoms, which were quite serious for two days, were soon dissipated. The fifth day the mouth looked well, and I removed the two last sutures. The suppuration ceased to be fetid about the eighth day. When I left the hospital, three weeks after, the interior of the mouth was of a lively red, scarcely sensible, and in a fair way to heal. I understand that this woman returned to her village before the completion of the cure, and after some months the primitive affection reappeared. In another patient, operated upon in the same hospital in 1830, and for whom I only took away the left alveolar border, the cure, which was completed in twelve days, has since continued perfect.

It seems to me, that for a disease of one of the halves of the superior maxillary bone, the method that I have just described will ordinarily be sufficient, and that it is difficult to imagine one more simple or easy. The crucial incision, employed by Mr. Lyme is more liable to injure the duct of Steno, and does

not more certainly expose the parts to be removed. The employment of a small scoop has appeared to me especially useful, and may be of great assistance. If the alveolar edges only be diseased, the cutting forceps, or even the small scoop that I use, enables us to remove the whole affection without dividing the lips. In other cases we must, if it cannot be dispensed with, divide the tissues on each side, following the oblique line that I have above indicated. It is, however, one of those operations, the manual of which must in some degree be accommodated to each particular case, and in which we should be cautious not to bind ourselves down too rigidly to any set of rules.

The extraction of a simple exfoliation of the upper jaw, comprehending even a great part of the bone, such as occurred to M. Roux, in 1829, like that of the lower jaw, produces not near so great a deformity as amputation. A new production almost always takes the place of the original, and in one singular case, observed by M. Krimer, the molar teeth themselves were reproduced.

CHAPTER II.

Excision of the Articulations.

History and Value.—Although there is not one of the articulations which at the present day has not undergone excision, yet there are some of them on which this operation has been more frequently practised than others. As a general rule it is better adapted to the thoracic than the pelvic members, and with them in proportion to their distance from the trunk. Although of apparently modern origin, excision of the articular heads was not unknown to the ancients. Hippocrates speaks of it in the articulations of the foot and hand, *et in tibia ad malleolos, et in cubitu ad juncturam manus.* It is evident, in fact, that in their ignorance of hemostatic agents, they would use every operation that could relieve them from the necessity of amputating a member. None of them, however, give the details of the method that they pursued, and it is only since the time of White that it has been looked upon as a distinct operation. Park, who wished to extend it to all the articulations, ultimately lessened its importance very much. M. Moreau is in reality the first who truly demonstrated its value. The dissertation of Wachter, published in 1809, being much more theoretical than practical, would have remained unknown, like that of Chaussier, if it had not been for the labors of Champion and Roux, Jeffrey of Glasgow, Crampton of Dublin, and Lyme of Edinburgh, who at last have succeeded in fixing public attention upon the subject. In spite of the facts already known, the excision of diseased articulations is far from being approved by all operators. Compared with amputation, its advantages and inconveniences are so nearly balanced, as in fact to justify hesitation. Its *manuel* is delicate, painful, and commonly very long; presenting in some cases numerous difficulties, and necessarily involving acute suffering. Although

the diseased bone may be removed, some portion of altered tissues may be left. The resulting wound is extended and irregular, and almost always becomes the seat or source of profuse suppuration, of reabsorption, or dangerous phlebitis. The cure, when it occurs, is often deferred for months, and sometimes even for years. The limb remains more or less stiff, sometimes fixed, and commonly drawn by the muscles in one direction or another, and is so deformed as to be almost unfit for the performance of any of its functions. Amputation, which is generally easy, prompt, and consequently less painful, at once relieves the patient from the bone, and all the affected soft parts. When performed upon the healthy tissues, it gives a clean incision, easy to unite, of less extent, less disposed to suppurate, and less favorable to the development of phlebitis and metastasis. The cure, more probable and prompt, is also more complete. To these objections it may be answered, that it is in the power of the intelligent surgeon to surmount the difficulties of the operation, and shorten its duration; to know whether he can or cannot remove the whole disease; that if the bone be removed, the neighboring tissues, however altered, most frequently may be restored to their natural condition; that a fungous or lardaceous degeneration of the ligaments, cellular tissue, and skin, is not always an obstacle to cure; that as the principal arteries, veins, and nerves, are left untouched, the operation must in reality have less influence on the rest of the system than amputation, properly so called; that some patients are cured very promptly, as Mr. Lyme cites some who used the limb after a few weeks; that the new substance formed in place of the excised matter acquires solidity enough to replace the articulation to a certain extent, and yet permit voluntary movements; that with the aid of splints and proper dressing all unnatural deviation of the member may be prevented, whilst anchylosis may be obviated by early and suitable movements of the parts; in fine, that however deformed it may become, it will always be adapted more or less to a great many uses, of which the patient would regret to be deprived: from all of which it follows, as far as I am permitted to judge, that the mass of the advantages of excision is more considerable than that of the inconveniences, and that it deserves to be counted among the efficacious resources of surgery.

The apparatus should consist in the first place, of that which is adapted to amputation; so that, if any accidents or unforeseen circumstances present themselves at the moment of the operation, we may proceed at once to amputation instead of excision: then some peculiar articles, for example, several strong spatulas, a gouge, a leaden hammer and a chisel, some saws, cock's-comb, circular, or semicircular form, a chain saw like that of Dr. Jeffrey's, or a saw like that of M. Machell, or a flexible one, such as the American and English surgeons often use; finally, one or more thin flexible plates of wood, pasteboard, lead or other metal, or simply a straight many-folded compress, proper to place between the bone and soft parts. Besides these, there should be one of Scultet's bandages, cushions, splints—a sort of fracture apparatus for the dressing.

SECTION I.

Thoracic Members.

Art. 1.—*The Hand.*

If the anterior or posterior third of one of the last four metacarpal bones should be diseased, that portion may be excised without the amputation of the whole finger. Many surgeons had suggested, and even performed it at the commencement of the present century; as is proved by several theses on the subject. It is, however, to M. Troccon, that we owe its subjection to fixed rules. Mr. Wardrop, who performed the operation on two of the metacarpal bones, is not the only one who has used it on living man. The head of the first phalanx of the thumb was thus successfully excised at the commencement of this century, by M. Bobe. Mr. Evans reckons two similar cures, and M. Roux has been not less successful upon some others of the metacarpal bones.

Operation.—This forms, in fact, but one of the steps of extraction, properly so called, of the same piece of the skeleton. After dividing the teguments, separating the extensor tendons, scraping the bone on each side to detach the interosseous muscles, disarticulating the extremity which is to be removed, there is nothing more to be done than to slip a strip of wood, pasteboard, or the like, beneath its anterior face, and then divide it sloping or perpendicularly with a small saw, such as Jeffrey's chain saw.

Art. 2.—*The Wrist.*

Others, besides M. Roux, and M. Hublie, of Provins, have excised the carpal extremity of the fore-arm. According to MM. Bobe, and Moreau, it was performed successfully nearly thirty years ago, by M. Clemot, of Rochefort, on a subject whose radius and ulna were luxated, and projected considerably through the soft parts. M. Hublie's attempt, which was completely successful, belongs to the same class. There was a luxation of the hand, and a projection of the bone through a laceration of the integuments. The extensor and flexor tendons were uninjured: the surgeon resolved, after properly isolating them, to remove the exposed portions of the radius and ulna, and then return the arm and hand to their natural position. After the cure, which occurred without any serious intervening accident, the fingers could be moved with almost as much facility as before the disaster. There should be no hesitation, if the reduction of the luxated bone be impossible, or too difficult; but there is another sort of incision, the utility of which is not so well demonstrated: I speak of that relating to some organic lesions of long standing, such as caries or necrosis. These diseases are rarely so serious at the wrist as to require amputation, without being attended with profound affection of the carpus and surrounding soft parts. But supposing the thing should be necessary, there are two methods that may be followed, and which have been tried.

Operation.—1st *Method.*—An incision on the radial side of the fore-arm, and another on the ulnar, extending from the root of the thumb and from the last metacarpal bone to two or three inches above the styloid apophyses of the radius and ulna, and a connexion of these incisions over the posterior face

of the wrist by a transverse incision, permit us to dissect and evert a flap that will expose the whole dorsal face of the articulation. The flesh in front should then be detached from the bone, so as to enable us to pass between it and the latter a thin piece of flexible wood, lead, or pasteboard. The radius and ulna are then to be divided with a saw, above the diseased spot. The pieces are then successively separated with a bistoury from the carpus, with which they are articulated. The wound is then to be closed by means of several stitches. Light pressure will bring together the internal faces of the wound, and it is not impossible for the extensor tendons to recover their power over the fingers. In this manner the operation is very easily performed on the dead subject, whilst the radial and ulnar arteries are easily avoided in detaching the flesh from the anterior face of the wrist. But one of the advantages of excision being the preservation to the hand of the most of its movements, it is important to have a method which will leave untouched all the extensor tendons.

2d. *M. Dubled's Method.*—After having made an incision first on the inside of the ulna, M. Dubled detaches the lips of it from the posterior and then the anterior face of that bone; draws then away from it; divides the lateral ligament; abducts the hand; isolates completely the head of the bone; projects it as far as possible; detaches it from the radius; passes between the two bones a plate of wood or lead, and detaches the part affected with a saw. The same process is followed for the external edge of the articulation; and as the ulna is already excised, it is then much more easy to turn the hand inward, draw out the radius, and perform the excision. In this manner all the tendons will be saved, and the consequences of the operation become evidently more simple. In practising it upon the dead subject, it appears to me very easy of execution; but it is not certain that it will be the same on living man, and on a deformed hand.

Moreau and Roux's Method.—The operation adopted by Moreau, Roux, and Lyme, without being much more complicated than that of M. Dubled, has the advantage of rendering the incision of the heads of articulation very much more simple. A transverse incision, which begins at the carpal extremity of each lateral incision, and prolonged from eight to ten lines upon the dorsal face of the wrist, circumscribes a small flap in the form of an L, over the posterior region of the radius and ulna. They are dissected and raised up one after the other, commencing with that over the ulna. After separating, detaching, and isolating the tendons, a protecting compress should be passed between the two bones by means of a spatula, and brought out between the palmar face of the ulna and the soft parts. An assistant immediately takes hold of it, and draws the two extremities towards the radius, so as to press the soft parts towards that bone. Then with a saw the surgeon makes the division of the bone, which he then detaches from the carpus and radius, by means of a bistoury. He then dissects the second flap with the numerous tendons and the radial artery which present themselves on this side. To finish, he has but to do the same on the radius as he has just done upon the ulna. Moreau's patient, thus operated upon, was cured. But we cannot give a just estimate of the value of the facts in the case, for the want of minuteness in the detalis. I am ignorant of the ultimate results of M. Roux's case.

Art. 3.—*The Elbow.*

The excision of the elbow was first performed with success by Wainmann, who removed only the *trochlea*, or pulley of the humerus, for a luxation of the elbow; proposed by Park, of Liverpool, in 1781, as applicable to chronic diseases; practised on the living subject, in 1782, by Moreau; shortly afterwards by Percy, Binns, and many other military surgeons. It has been attempted five times by M. Roux, once by Mr. Crampton, four times by Mr. Lyme, once by Mr. Spence, and since their first attempt, MM. Moreau, father and son, MM. Champion and Mazzoza, have reported three or four new examples of it; so that at the present time we can enumerate nearly thirty cases.

Operation.—Park's Method.—Park thought it sufficient to make an incision parallel to the axis of the limb, extending two or three inches above and below the olecranon. Its lips being separated, he endeavored to divide the lateral ligaments and the tendon of the triceps, so as to luxate the extremity of the bone backwards; but finding it too difficult, he first excised the olecranon, and then accomplished his object more easily. The first step of the operation over, Park made section of the humerus upon a plate which he had placed between the anterior face of the bone and the flesh, about two inches above the articulation. The sides of the division were brought together, and kept so by means of small bandages. In his letter to Pott, the author agrees that this method will not probably serve for a diseased and swelled articulation; but that in such a case he would add a transverse incision immediately above the joint; dissect up the four flaps, the whole posterior face of the bone thus exposed, and remove with the saw successively the lower head of the humerus and the superior portion of the bones of the fore-arm. Such an operation should not be performed in any case, either in its simplicity or with the crucial incision, although Mr. Lyme may have used it once successfully.

2. *M. Moreau's Method.*—Instead of cutting on the median line, M. Moreau commences by dividing the whole thickness of the soft parts from below upwards, for two or three inches, beginning at the condyles, and following the edge of the humerus. A third and transverse incision unites the first two immediately above the olecranon, forming a quadrilateral flap, which is to be dissected and turned up on the posterior face of the arm. With a bistoury laid flat upon the anterior face of the humerus, the flesh is to be carefully detached. Then, having put a flexible strip of wood in the place of the instrument, the remainder of the operation is performed like that of Park. If the extremity of the radius and ulna must be removed, it is sufficient to prolong the lateral incision a little downward, and thus form a small flap below, which, being dissected, renders the section of the bones that it covered very easy.

3. *M. Dupuytren's Method.*—The method of Moreau is such that it is worthy of being followed, as it has been by Roux and Lyme, at least in most of their cases. Yet they found it necessary to modify it in some respects. M. Dupuytren has shown that the ulnar nerve, which is almost necessarily sacrificed, can and should be preserved. After forming the quadrilateral flap, and exposing the superior extremity of the ulna, like Park, he begins by excising the olecranon; then carefully incises the sheath that envelopes the ulnar nerve behind the trochlea; pushes this nervous cord inwards and before the

articulation, where an assistant holds it with a curved sound, the handle of a scalpel, or even the finger, until the extremity of the humerus is removed.

4. *Process adopted by the Author.*—The patient must be placed on his belly, or at least on the healthy side. An assistant compresses the humeral artery, and supports the soft parts of the arm. Another person holds the fore-arm extended. The surgeon on the outside, and armed with a straight bistoury, first makes an incision two inches long upon the external edge of the humerus, commencing or ending over the epicondyles, and extending upward so as to separate the anterior brachial muscle from the external portion of the triceps. A second incision is then made upon the internal edge of the arm, the inferior extremity of which should fall rather on the side of the olecranon than upon the epitrochle, in order to avoid the ulnar nerve. After uniting these two longitudinally by means of a third and transverse incision, which should divide the tendon of the triceps, the flap is easily dissected and turned up. An assistant then seizes this flap, and if the extremity of the fore-arm appears sound, the surgeon proceeds to the excision of the humerus. Otherwise the lateral incisions must be prolonged, and an inferior flap formed analogous to the other. As soon as the ulnar nerve is exposed, it is isolated from the attachments that fix it between the trochlea and olecranon; and whilst the arm is extended, it is carried behind the internal tuberosity of the humerus as above described. Then the operator brings forward the undivided flesh, and slightly flexes the arm; separates the fleshy fibres from the anterior face of the bone with the point of the bistoury; makes use of the saw; takes hold of the superior extremity of the bony fragment; separates the tissues from it that he may turn it downward and backward; divides the anterior, the internal and external lateral, and the posterior ligaments. If the excision of the radius and ulna must also be performed, he detaches the anterior brachial and biceps muscles below the disease, and then divides those two bones with the saw from before backwards, or *vice versa*, according as the state of the parts may require, or render convenient. It would also be better in this case not to disarticulate the humerus, but pass at once to the excision of the radius and ulna, as Mr. Lyme advises. If the bones of the fore-arm be perfectly sound, we can scarcely conceive the utility of the extirpation of the olecranon. When they are diseased, the operation becomes necessarily longer and more serious, and seems to me to offer but little chance of success, if it is necessary to extirpate below the bicipital tuberosity of the radius, because then the attachments of the two principal flexor muscles of the fore-arm are destroyed. The brachial artery, separated by a thick muscle from the humerus, is never difficult to avoid. There is greater risk when it has descended to the fore-arm on a level with its bifurcation. It is of great importance to divide the radius and ulna above the insertion of the anterior brachial, and especially of the biceps muscle. Yet Mr. Lyme seems to have extended the excision to below the tendon of these muscles in some cases, in which, nevertheless, the use of the hand was retained.

After you have removed the bone, tied the vessels if there be any that require it, cleansed the wound, and satisfied yourself that there remains nothing of the disease behind, the elbow is again extended, the flaps brought together, united by two or three stitches, and in the same manner attached

to the anterior soft parts. Pledgets of lint, graduated compresses, a Scultet bandage, pads, and two thin splints, keep the parts in contact, and the whole limb in the most perfect rest. The excision of the elbow is a minute, long, and extremely painful operation. It is rarely followed by immediate reunion. It is very frequently followed by profuse suppuration. One of M. Roux's cases continued nearly a year before complete recovery. It can only be used where the skin and a part of the muscles remain sound, as in simple caries or necrosis, or in a comminuted fracture of the articulation. These circumstances have alarmed operators, and tended to render this operation more rare than would at first be imagined. Yet it has always been successful with the surgeons of Bar. M. Roux also cured three cases. His first patient, operated upon in 1819, was well of the operation, when he died of phthisis. The second has established himself as scissors-grinder on one of the bridges of Paris. The third, on whom I saw the operation performed, has re-assumed her trade of mantua-maker. A hemorrhage rendered the immediate amputation of the arm necessary in a fourth, who died three days after. M. Mazzoza's case was successful. The patient of Mr. Crampton, operated upon on the 2d of January, 1823, signed his own discharge the 29th of November following. Of the four operated upon, from the first of October, 1828, to the first of October, 1830, by Mr. Lyme, two are dead. A third had to submit to a subsequent amputation of the arm. Eleven have been perfectly cured; some by immediate reunion, others after a longer or shorter time, and all preserved most of the movements of the limb. The patient of Mr. Spence, treated, in 1830, was equally successful; so that it is impossible not now to admit excision of the elbow as one of the valuable resources of surgery, notwithstanding the opinion of M. Larrey, and my former preceptor, M. Gouraud, who will only adopt it in cases of comminuted fracture or luxation, with division of the integuments and projection of the bone. It is true that the removed parts cannot apparently be reproduced, as some persons at first believed, and that the articulation of the elbow is ever after wanting. But in their places there sometimes forms a substance sufficiently solid to serve as a fulcrum, upon which the muscles can flex and extend the fore-arm. The patients once cured, can always use their hand, and are certainly very happy to escape amputation—the only resource left if excision must not or cannot be attempted.

If one of the condyles or the olecranon only be diseased, the operation must be performed, as M. Moreau has once performed it successfully; namely, make one of the lateral incisions above-mentioned; make a second for the extremity of the first across to the middle of the breadth of the arm and below the olecranon; dissect and evert the triangular flap thus made, upward and towards the median line of the arm; then, by means of a chisel or gouge, remove the part of the bone affected, and return the flap to its proper place for immediate reunion.

Art. 4.—*The Radius.*

A necrosis, with fungous degeneration of the periosteum extending almost throughout the whole extent of the fore-arm, gave me the idea, in 1826, of excising or removing the radius (this being the only part affected), instead of

amputating the arm; but the patients preferred submitting to the latter operation. Upon the dead subject, it may be done without difficulty, and without destroying any tendon or muscle. The fore-arm is to be placed in a flexed position. An incision, parallel to its axis, exposes first the external and anterior edge of the radius. The two lips of the wound are then separated from its posterior and anterior faces, by means of a bistoury, to a point a little below its middle portion, where it lies almost naked beneath the teguments. At that point, the operator should endeavor to pass a grooved sound between its ulnar edge and the flesh, to serve as a conductor to a flexible saw. He then divides the bone from within outward by means of this latter instrument, and then extracts the two fragments, one after the other, by dissecting them carefully from their free extremities towards their articulations. If the integuments, being difficult to depress, oppose the introduction of the saw, there is no objection to dividing them on each side of the lips for some lines. It is now an operation which has received the sanction of experience, Dr. R. Butt, of Virginia, having performed it upon a man, in 1825, with complete success.

Art. 5.—The Shoulder.

In the year 1740, a surgeon at Pezenas, named Thomas, made known a case in which the head of the humerus, being in the state of necrosis, was successfully extracted. A little later, Boucher, in his memoir upon gun-shot wounds, demonstrated that the head of the humerus, reduced to splinters, could be removed without much difficulty, and without a sacrifice of the whole member. The same doctrine has since been supported by Percy, M. Larrey, and almost all military surgeons. The theses of MM. Triad and Legrand may be consulted on this subject. As to excision in the case in which the head of the bone has been the seat of an organic lesion, requiring its removal, it has been performed, first by White, David, Vigouroux; then by Moreau the father, Bent, Orred, Percy, Moreau the son, and also, it is said, by Larrey, Grosbois, Porret, C. Petit, Brulatour, Roux, Willaume, Bottin, &c. It is known, from the testimony of Sabatier, that in 1789, a child presented with its right hand to the academy of surgery the scapular extremity of the numerus of that side that had been taken from him by the surgeon-major of the regiment *de Berry*. The method of operating must necessarily vary according to the morbid state.

Operation.—1st. *White's Method.*—When most of the surrounding tissues are healthy, or when the bone is reduced to fragments, the operator may, according to M. Larrey and M. Porret, be content with an incision parallel to the fibres of the deltoid muscle, extending from the summit of the acromion four or five inches down, and penetrating to the articulation, as in Pojet's method for the removal of the shoulder, published in 1759. Then, seizing the elbow, White used it to sway the humerus, and thus produce a luxation of its head upwards through the soft parts. M. Larrey separates the lips of this first incision, opens the capsule, and then divides, by means of a button-headed bistoury conducted by the finger, the tendons of the supra and infra spinatus, subscapularis, and teres-minor muscles, so as to remove all difficulty of turning out the head of the bone. In both cases when the operation has reached this point, a thick compress, or some protecting plate, is to be

placed between the neck of the bone and the teguments, so as to saw without inconvenience.

2d. *M. Moreau's Method.*—M. Moreau remarks, justly, that the simple incision, recommended by White, and even when modified, as by M. Larrey, must be insufficient in most cases. According to him, two incisions of four inches in length parallel to the fibres of the deltoid, one on its anterior the other its posterior border, and united below the summit of the acromion by a transverse incision, would be infinitely superior; thereby forming a trapezoid flap, which should be dissected and turned down towards the insertion of the deltoid. Then all the anterior portion of the joint will be exposed. Nothing will be more easy than to divide the capsule, turn out the head as well as the superior portion of the bone, and perform the excision. The flap, then turned up in its place, should be secured above and at its sides, by a few stitches.

3d. *Manne's Method.*—M. Moreau's plan evidently renders the excision of the humerus much more easy than White's; but his large flap, which differs from the deltoid flap of la Faye only in being detached and turned downwards instead of the reverse, renders immediate reunion difficult, and exposes to fistulæ, which should be avoided. This plan, therefore, should not be wholly adopted. It would be better, if the surgeon desired to have a trapezoid flap, to follow the advice of Manne, *i. e.* make two lateral incisions, like Moreau, unite them by their inferior extremity, dissect and raise the flap from point to base, exactly as la Faye recommends for amputation of the arm at this joint.

4. *Sabatier's Method.*—Instead of taking so much care of the soft parts, Sabatier formally advises us to circumscribe a portion, in form of a V, in the midst of the deltoid muscles, and then to excise this triangle to expose the naked capsule of the joint. It is difficult to imagine what prompted Sabatier in the description of this method, and why he directs the removal of the flap rather than its preservation. By dissecting it up, as M. Gouraud did, in 1801, and as it has recently been done by Dr. Smith, in America, the operator can easily extract and excise the bone.

5. *Bent's Method.*—After in vain trying White's method, Bent, who was one of the first to remove the humerus, thought it was necessary to detach it outwardly from the acromion, inwardly from the clavicle, and then to divide the deltoid muscles transversely, so as to form a T incision, which would permit him to dissect the two triangular flaps, one external and the other internal, and afterwards act freely upon the joint.

6. *M. Morel's Method.*—M. Morel was dissatisfied with all these methods, and made a semilunar flap, with the convexity downwards, upon the anterior face of the shoulder. The operation was long, but the patient was cured.

7. *Mr. Lyme*, who has twice removed the head of this bone with success, makes a flap upon the external half of the deltoid, giving it a triangular form, the anterior leg of which is represented by White's incision, whilst the other, much shorter, is carried obliquely upward and backward towards the posterior edge of the arm-pit. The flap being raised, the surgeon carries the elbow in front of the thorax; divides the capsule, luxates the head of the humerus; excises it; brings down the flap, and proceeds to the dressing.

Remarks.—The diseases which call for excision of the humerus, are the

same as those which otherwise would require disarticulation of the arm; consequently the various methods of operating proposed for the latter will also apply to the former. Thus instead of making a flap by means of three incisions, as La Faye did, it would be much more simple to imitate M. Morel, or to make a single cut as MM. Dupuytren and Lisfranc do, or even to follow the method of Mr. Cline or Onsenort. It is also evident that excision differs from amputation at the joint, only in the latter steps of the operation.

We may therefore adopt any method that may appear most easily to isolate the head of the bone, either by penetrating from above downwards, from without inwards, or in any other manner, and just as teguments and muscles may be more or less altered in this or that direction. Whatever method we select, Mr. Guthrie recommends us to remove as much of the articular capsule as possible; because, says he, the more there is left of this fibrous purse, the less will be the chances of an immediate reunion. This practice, although good in amputations, is not to be followed in excision; because, in proportion to the preservation of the fibrous tissues will be the future strength and stability of the limb. When the extremity of the humeus is removed, the operator can assure himself of the state of the acromion, of the corocoid apophysis, and the glenoid extremity of the scapula. If these parts be not altered, he then proceeds to the dressing; otherwise, he must remove them with the cutting forceps, the gouge or chisel, or even with the saw, proceeding as we have described in the removal of the shoulder; that is to say, if the alteration of the bone extends beyond a certain distance, it will be necessary to extend the incisions which circumscribe the base of the flap, under the spine of the scapula, and above the internal edge of the coracoid process, in order to expose the whole extent of the diseased parts. It is well known that M. Larrey does not hesitate to remove these three apophyses, and even the acromial extremity of the clavicle. Mr. H. Hunt proceeded in the same manner in a case in which Mr. Brown, in 1818, had removed the head of the humerus. This daring effort was crowned with complete success. Moreau had this excision in view when he recommended turning the deltoid downwards. Then, in fact, nothing prevents us from forming another flap in the opposite direction, which would render the removal of the scapular apophyses quite easy. But as it is always possible to retain sufficient substance at the root of the flaps of La Faye, Dupuytren, or Lisfranc, to prevent mortification, the motive that influenced Moreau will not suffice to make us pursue his method, after seeing that of the other operators. The operation being finished, the extremity of the body of the humerus is returned to its natural place by giving the arm its natural direction. Whatever may be the form of the flap, its lips must be exactly brought together, at least towards the lower angles of the solution of continuity. To retain the bleeding surfaces in contact, the origin of the limb should be covered with plates of agaric, pledgets of charpie, or graduated compresses. A many-tailed bandage, cushions and splints, should fix the whole in such a manner as to permit the dressing of the disease as often as it may be judged advisable.

Some have thought that the portion of the bone removed would be reproduced. This is an error. From the case given by Chaussier, it is seen that a conical osseus mass fills up the glenoid cavity, ending, it is true, by coming in contact with the superior extremity of the body of the humerus, and

being slightly excavated, really produces a new articulation that allows the arm almost all its original movements. In one of the cases reported by Moreau, the superior part of the bone of the arm was drawn and fixed upon the breast, when a sort of artificial articulation was ultimately formed. But nothing in these cases indicated a reproduction of the bone, and most frequently the superior extremity of the humerus remains movable in the midst of the soft parts. Nevertheless, the patient preserved the motion of the fingers, the hand, and the fore-arm, and even most frequently could move the member to a certain distance in every direction; only he is unable to raise it at a right angle with the trunk, or to hold it far from the breast. After such an operation, it is infirm; but it is better to have a limb deformed, and somewhat reduced in its functions, than none at all, and the last cases reported by Mr. Lyme demonstrate that the use of the arm may be almost entirely restored.

Art. 6.—*The Clavicle.*

The clavicle is situated very superficially, it is true; but as it covers some organs, the wounding of which would be very dangerous, surgeons have not dared to attempt its excision, except in cases which have just been stated. Yet there are circumstances sufficiently numerous, which require this operation, if we wish not to abandon the sufferers to certain death. Sometimes necrosis or caries may affect its scapula, sometimes its sternal extremity; sometimes its middle, or even throughout its whole extent. The mode of making the excision or extirpation, is difficult to lay down, because the disease that requires it may produce numerous changes in the anatomical disposition of the neighboring parts.

1st. *Acromial Extremity.*—In a woman affected for a long time with necrosis of the external third of the clavicle, I first made a crucial incision, the branches of which were each about four inches long. After dissecting and separating the two flaps, and dividing the acromio-clavicular ligaments, together with some fasiculæ, from the origin of the deltoid and trapezius muscles, I was able, with the assistance of a plate of wood sunk into the articulation as a lever, to raise up the diseased bone, and thus detach it from the healthy parts. If it had offered too much resistance, a common saw, or, better still, a cock's-comb saw would have enabled me to make the section downwards or backwards. Supposing it had been too much buried, I would have carefully isolated it from the soft parts before and behind, passed one of Jeffrey's chain-saws under its inferior face, and cut it from behind forward, and then disarticulated and removed it. If the skin be not ulcerated, nor positively diseased, we would succeed as well, and, I think, even better, by making a triangular flap, by means of a transverse incision parallel to the internal edge and some lines below the clavicle, to be prolonged to the summit of the acromion; then another, much shorter, meeting the internal extremity of the first at a right angle. This flap, turned back, completely exposes the diseased bone, and will permit the application of the saw upon the sternal side of the diseased part, which, after the division, may with a bistoury and forceps, or an elevator, be removed as far as the acromion. This method would be more easily applicable to the sternal moiety of the clavicle; but in either case, on account of the axillary vessels, the operation becomes the more

delicate and dangerous, in proportion as the saw is applied nearer the middle of the bone.

B. *Extirpation.*—From the dead subject the clavicle is not difficult to remove. An incision, parallel to its cutaneous edge, reaching a little beyond its extremities, is commonly sufficient. Or two vertical incisions, about one or two inches long, may be added one to each extremity of the first, and then by dissecting up the flap, the bone may be completely uncovered. Then the operator may disarticulate it at either extremity, and seizing it with his left hand, detach it from its internal adhesions by the right, armed with a bistoury. The bone may also be sawed near its centre, and the two moieties separately removed. In a diseased state of the parts, this operation must be one of the most difficult in surgery. It was, however, once performed with complete success, by Dr. Mott, on the 17th of June, 1827, in New York, on a young man aged nineteen years, affected with osteo-sarcoma.

The tumor was as large as two fists, extending from near the angle of the jaw and the os hyoides in one direction to the point of the shoulder, and the sterno-clavicular articulation in the other. The operation was very laborious. It was necessary to apply more than forty ligatures before it was completed.

Dr. Mott commenced by making a semilunar incision with its convexity downwards, and reaching from one extremity of the clavicle to the other, as if to detach the tumor from below upwards; he then made a second, extending from the acromion to the outer edge of the external jugular vein; divided the platysma myoides, and a portion of the trapezius; passed first a grooved director, and then, by means of an eyed probe, a small chain-saw under the clavicle, which he divided a little nearer the acromion than the coracoid apophysis. Being yet unable to turn out the morbid mass, the operator connected the two other incisions by a third, at their sternal extremities; tied the external jugular at two points, dividing it in the interval; divided the external portion of the sterno-mastoid muscle two inches above its origin, and turned it down upon the sternum; separated and pushed the omo-hyoideus muscle, upwards and backwards; was also obliged to tie and divide the internal jugular, and to separate with some difficulty, by means of the bistoury or the handle of a scalpel, the subclavian vein, and even the thoracic duct from the degenerated tissues; numerous branches, coming, no doubt, from the inferior thyroid, transverse, cervical, subscapular, &c., arteries, were tied as soon as divided A last incision, the utility of which I cannot comprehend, was made over the line of the fourth rib, beginning at the first, and dividing the fibres of the great pectoral muscle. After dividing the costo-clavicular ligament and subclavian muscle, Dr. Mott was at last enabled to raise the tumor, and concluded by disarticulating the bone at its sternal extremity.

The wound was filled with charpie, and long adhesive strips used to hold its lips as near together as possible. No serious accident followed. The cure was nearly completed by the last of July, and by means of an appropriate machine, which to a certain extent supplied the place of the clavicle, the patient retained almost the entire use of the arm.

As such an operation should not be attempted but by the most skillful surgeon, it is useless, I think, to enter into any details, to show in what manner Dr. Mott's method could be advantageously modified. All such persons will easily conceive them, by recollecting the anatomy of the affected region, and

of course will have to conduct themselves according to the peculiar characters of the disease. Thus it was with M. Beauchene, who, being obliged more than ten years ago to remove a great part of this bone, and the rest of the shoulder, at Saint Antoine, made use of different incisions from those of Dr. Mott. M. Lucke found himself in the same situation in the excision of the shoulder, of which I have just spoken. Kulm, who extracted the clavicle in the early part of last century for a sarcoma of five pounds' weight, had also to invent his own method. Nor do I see why the ligature of the mass, so much extolled by M. Mayor, might not be practised, since the hemorrhage seems so difficult to arrest. The excision of the body of the scapula would be even more variable than that of the clavicle.

M. Jansan, who has performed it, began by circumscribing the tumor by two semi-elliptical incisions, taking care to preserve as much of the skin as possible; dissected up and turned back the two lips of the wound; detached the diseased mass in every direction as far as the subscapular fossa; but whilst he was raising it up it broke in the middle, and he was forced to separate the external half first. After dividing the attachments of the trapezius, the supra and infra spinatus muscles, the operator having discovered that the portion of the bone above the spine was healthy, separated from it all the diseased portion with a saw, and thus preserved the articulation of the arm. By another and the last incision, made obliquely upwards, forwards, and inwards, he exposed the whole tumor, dissected it carefully, lifted it up gently, felt the cellular tissue that fixed it to the arm, which he tore, and at last succeeded in detaching it entirely.

All the vessels were tied. The hollow of the arm-pit was filled with lint, and by the assistance of adhesive strips the lips of the wound were brought together, although the incision measured six inches in its transverse, and nine inches in its longitudinal diameter. The movements of the arm upon the glenoid cavity were preserved. The tumor weighed eight pounds and a half, was easily torn, and presented the aspect of the interior of a pomegranate.

SECTION II.

Abdominal Members.

If it be difficult to disprove at the present day the advantages of incision when applied to the thoracic, the same cannot be said as to the pelvic members. Here, an artificial member may supply almost all the functions of the natural one. There, on the contrary no machine can be so adapted as to render the same services to the patient. Whatever may be the deformity left in the arm, or in whatever state the hand may be, if they be preserved, they may always answer some useful purpose. Notwithstanding this, excision has been recommended for all the articulations of the inferior members, and even performed a certain number of times. Having treated of excision and extraction of the bones of the feet, in the article *Amputation*, I shall not recur to it, especially as they are governed by the same rules as those of the bones of the hand.

Art. 1.—*Tibio-tarsal Articulation.*

Gooch long since excised the inferior extremity of the tibia with success. This operation has been repeated by Cooper, De Bungay, Hey, Deschamps, White, and Taylor; and more recently by M. Delpech, and the Moreaux, father and son. MM. Jesse and Ladent, have been equally successful in excising the tarsal extremity of both the bones of the leg, although they had to remove two inches of the tibia on the right, and an inch and a half of both tibia and fibula on the left, in the case of a young girl. At the end of three months the patient could walk with a stick, which she has since laid aside. In almost all of these cases, excision was decided upon, it is true, but in consequence of complicated luxations or comminuted fractures. But many have also performed it for organic lesions, *i. e.*, while the parts retained their natural positions.

Operation.—1st. *Moreau's Method.*—M. Moreau recommends two incisions to be made on each side of the leg, one extending from the summit of the malleolus, three or four inches above, the other commencing at the same point, and carried forwards transversely to the insertion of the peroneus brevis on the external, or to the corresponding tibialis for the inner side. The longitudinal incisions should go to the bone, but the others only through the skin. He commences, by dissecting the external flap, to disengage the fibula from the tendons that surround it, and then divides it with a chisel or cock's-comb saw above the disease, and disarticulates it from above downwards, by dividing the fibrous fascia that connects it to the tibia, astragalus, and os calcis. The same course is pursued in isolating the tibia from the soft parts, and in dividing and disarticulating it. If the astragalus be diseased, it also must be removed totally or in part, as has been done by M. Moreau, the younger, After the operation the foot must be brought to the inferior extremity of the leg, and kept there by adhesive plasters and a suitable bandage.

2d. *M. Roux's Method.*—This is exactly the same operation as for the carpal extremity of the fore-arm. Instead of the chisel and mallet, the chain-saw of Dr. Jeffrey is better adapted to the tibio-tarsal articulation than anywhere else. Notwithstanding the narrowness of the interosseous space, M. Roux once succeeded in passing a compress through it, which enabled him to saw first the fibula and then the tibia without fear, having first brought it between the bone and the soft parts.

Value.—This excision, always difficult, may be sometimes followed by the most serious consequences. M. Roux's patient ultimately succumbed. After the most complete cure the member must necessarily lose some of its length, and the patient can walk only with the assistance of a more or less elevated shoe. It has no advantage over amputation. It seems to me that the excision of the tibia only can never accomplish the object the surgeon proposes. The foot, losing its principal support, will be in fact incapable of sustaining the weight of the body, and will be turned inwards, as M. Moreau, the younger, has observed in one of his patients. It would seem then, that the fibula, even when sound, must be excised whenever the tibia is to be removed. The parts to be preserved are, first, anteriorly, the tendons of the anterior tibial, some of the extensors, and the peroneus brevis; second, on the outside, the peroneus longus; third, on the inside, the tibialis posticus and the flexors; fourth,

behind, the semi-tendinous portion of these muscles; fifth, and lastly, the anterior tibial artery in front, and then the posterior tibial behind the internal malleolus.

Art. 2.—The Knee.

History.—The excision of the bones forming the femuro-tibial articulation, first recommended by White, has been put in practice twelve times; once by Park, with sufficient success to enable the patient to walk without the assistance of a stick; a second time, without success, the patient dying after some months from exhaustion; a third time, by Moreau, senior; twice by Moreau, jun., one of whose cases died three months after the operation, the other was for a long time obliged to use crutches. A case was presented by Mulder, in 1809. M. Roux has published a seventh. His patient died on the nineteenth day; the case was reported in 1815, to M. Gourard, by M. Haime, of Tours. Mr. Crampton performed it twice, first, on a young woman aged twenty-three, on the 7th of May, 1823, and the second, in 1824. The first recovered, and actually walked without crutches, notwithstanding the deformity of the member. The other died from the effects of the operation. Mr. Lyme has also had recourse to it twice; one of his patients died; the other, a child nine years old, recovered, and walks very well. According to this author, it has also been once attempted in Germany. It certainly is not because of its difficulties that excision of the knee should be proscribed, but because it is infinitely more painful, tedious, and dangerous, either immediately or secondarily, than amputation in the continuity of the thigh, and especially because, in the most fortunate cases, the preserved member is really less useful to the patient than an artificial leg. A shortening of from four to eight inches is necessarily produced. The articulation cannot be re-established. If the limb retains its faculty of moving, it is very irregularly, and is almost always very much bent outwards. Experience has confirmed all this. Of the eleven patients, the history of whose cases is known, five at least have succumbed. Some, like the patients of M. Roux, very suddenly; others, after long continued suffering. Almost all who have been cured, owe their recovery to the most extraordinary care, whilst they have run the greatest risk of losing their lives. Yet it is certain, whatever Mr. Lyme may say, that none can use the preserved, with the same advantage that they could use an artificial limb. The following methods should be adopted, when the operation is undertaken.

Operation.—1st. *Mr. Park's Method.*—A crucial incision, the transverse branch of which placed above the patella should comprehend one half of the circumference of the member, is the characteristic feature of Mr. Park's method. After having divided the tendon of the extensor muscles, everted the four flaps, raised up the patella, divided the lateral ligaments, pierced the articulation from before backwards, he pushed a large knife under the posterior face of the femur, to separate it from the soft parts, taking care of the popliteal vessels, and sawed the bone above the condyles.

2d. *M. Moreau's Method.*—The articulation of the knee being very similar to that of the elbow, M. Moreau thought that the excision of one should be

performed like that of the other. Accordingly he commenced by making two lateral incisions a little behind the borders of the ham; which were terminated at the bottom by a transverse incision, uniting them; and divided the skin and the end of the triceps femoris below the patella, so as to reach the articulation; then denuded the posterior face of the bone from the surrounding flesh; the quadrilateral flap, made by the three incisions, was then dissected and raised up; and the section of the femur made with the same caution, as by Park. If the bone of the leg be at the same time affected, the external incision should be prolonged to the head of the fibula. Another should be made over the crest of the tibia, thereby forming two lower flaps, one internal the other external, which are to be dissected and depressed. The posterior face of the tibia is to be isolated from the vessels and nerves, as well as the head of the gastrocnemii muscles, so as to be able to remove the whole of the diseased bone with the saw.

3. *MM. Sanson and Begin's Method.*—Instead of making first a large quadrilateral flap, the new editors of Sabatier commence by a transverse incision below the patella, extending from one lateral ligament to the other, and penetrating at the first cut into the articulation. This done, they disarticulate the femur or tibia only, if there be but one of them diseased, by making two lateral incisions from the extremities of the first, upwards or downwards, and shorter or longer, according to the length and situation of the affected portion of the bone.

4. *Mr. Lyme's Method* differs from all the preceding in more than one respect. This operator makes two semilunar incisions in front of the joint, one above and the other below, which are united on a line with the lateral ligaments, and form a transverse ellipsis enclosing the patella. He excises this ellipsis and the bone contained in it; divides the ligaments, opens the articulation, and removes, one after the other, the extremities of the femur and tibia.

Remarks.—Whatever method may be followed, the bleeding surfaces must be brought together, and occupy the place of the removed bone; a few stitches or adhesive strips, some charpie, compresses, cushions, splints, and, in fine, all the apparatus for a complicated fracture of the leg, are necessary to complete the dressing, and hold the limb in the most perfect state of rest.

These various methods all permit the accomplishment of the object in view. The operation is alike possible, whether we make a crucial incision, like Park, or a quadrilateral flap, like Moreau, or penetrate the joint at the first stroke like Sanson and Begin, or remove or not the patella, like Mr. Lyme. It is the consequences, and not the operation that are so dangerous, and which should, in my opinion, cause it to be generally proscribed. I would admit no exception, but where the articulating surfaces alone are diseased, so as to permit the removal of the whole disease without excising more than one or two inches of each bone.

If the rotula be carious, or affected with necrosis, it should be removed without hesitation, even if the joint should be opened. One such case only is known in medicine, and in that the disease was cured. I have seen two persons in whom it was fractured, and although the fragments were separated more than six inches, they preserved the use of the leg.

Art. 3.—Head of the Femur.

Towards the middle of last century, White ventured to propose the disarticulation of the femur, and the excision of its superior extremity. A simple incision was to enable him to expose the articulation, open the capsule, luxate the bone, and turn it out for excision. Vermandois and Petit-Radel revived this idea without any modification. But Rossi soon saw that the incision proposed by White was insufficient, and that it would be more easy to reach the joint by making externally a triangular flap. Chaussier, nearly thirty years ago, made a number of experiments upon this subject, and excisions in general. According to him, excision of the head of the femur in dogs is not much more dangerous than that of the humerus. There forms in place of the excised bone, a matter first fibro-cellular, then cartilaginous, and finally, so solid as almost to equal the hardness of the bone itself. Wachter expresses himself nearly in the same terms in his dissertation. Still there is at present but one case given of the excision of the head of the femur, and the results attending it, as given in the American journals, are so strange, that it is difficult to give them entire credence.

If the head of the femur should escape through the torn soft parts and could not be reduced, it might, without doubt, indeed it should be removed with the saw, and especially if it be fractured; but what is the disease so serious as to require removal of the head of the femur, that would attack it without also implicating the cotyloid cavity? and when the bones of the pelvis are diseased, of what use would it be to excise the femur? However, if some one should desire to attempt it, the most simple method would be, provided there already existed no external wound, to make a simple semilunar incision, extending from the antero-superior spinous process of the ileum to the tuberosity of the ischium, forming thereby a large flap with its convexity below, behind the articulation, and at the expense of the soft parts at the origin of the limb. After having raised this flap up and divided the posterior half of the capsule, abduct and flex the thigh at the same moment to divide the inter-articular ligament; pass the knife between the head of the bone and the cotyloid cavity, inward and forward to the groove at the neck of the femur to detach the rest of the capsular ligament, and turn out the portion of the bone to be removed. After its removal, there will be little else to do than return the thigh to its natural position, bring down the flap, and secure it with stitches or adhesive strips, and for the rest pursue the course usual in complicated fractures of the superior part of the bone.

Artificial Articulation.—Some operators have made use of another kind of operation on the femur. When the hip is anchylosed, they have proposed a kind of new joint by sawing the bone near the body or at the neck, and even by excising a portion if judged prudent. Twice already has this daring operation been attempted in America. The first time, in November, 1826, with entire success, by Dr. J. R. Barton; and the second, by Dr. Rogers, at the hospital of Philadelphia. I understand from Dr. Buck, that in the last case, the patient, who for some time gave strong hopes of a second instance of success, ultimately died. Without wishing to become its

defender, I would however remark, that with the aid of an incision over the external and superior part of the member, or of a crucial incision, and one of Jeffrey's chain-saws, or an elastic, or even a small hand saw, Barton's operation is much less difficult than one would at first imagine. And I would add, as to the probability of its effects, that in a case, published by M. Pailloux, of false articulation of this joint following the fracture of the neck of the femur, the patient walked very well before his death; and that M. Martin has found another case of false articulation of the same species, between the great trochanter and body of the bone, the head of it being destroyed; and, in fine, that the number of non-consolidated fractures of the part, justify to a certain extent, this apparently dangerous operation.

TITLE IV.—TREPANNING.

Trepanning appears to have been practised from the highest antiquity. Its origin is lost in the obscurity of time. It is used on almost all the bones of the body, but especially on those of the head.

CHAPTER I.

THE CRANIUM.

Notwithstanding the improvements it received from the physicians of ancient Greece, and the abuse it suffered in the middle ages from those charlatans that Sylvaticus called *circulatores*, trepanning is one of the operations that has most strongly attracted the attention of surgeons, since the time of G. de Chauliac. For a long time it was thought the principle and almost only remedy for the traumatic lesions of the head, produced by blows, falls, &c. At the present it is but rarely resorted to. No person would think now of imitating Panaroli, in trepanning for a simple chronic cephalalgia, even if it were most violent, or of venereal origin; nor for epilepsy, although Marchetti has used it once successfully, and M. A. Severin has formally recommended it for that disease; nor for fractures of the inner table of the bone, for which Garengeot speaks of using it; nor for remedying an attrition or simple contusion of the diploe, as Acrel, Richter, and Fritz recommend. Mr. Ramsden, as stated by Mr. S. Cooper, has seen a patient, on whom the os frontis had been perforated for a simple sub-orbitary pain, die of meningitis the fourth day after the operation.

Indications.—Its object being to give exit to foreign fluids extravasated in the cranial cavity, to permit the elevation or removal of any fragments of bone or other bodies that may have been forced in upon the brain, and whose presence may impede the functions of that organ, there arise indications very difficult to appreciate. Nothing is more vague, than the signs by the aid of which authors pretend to recognize the various lesions for which they use it. The sound of a broken kettle, perceived at the moment of the accident, and the sound given by percussion on the bone with a small stick, recommended by Lanfranc, are altogether insignificant. The same may be said of the tendency of some patients to carry their hands mechanically to some certain point of the head; of a shock felt by others the moment that a piece of thread or string, held between the teeth, is snatched from the mouth; of the painful sensation produced by a deep inspiration, and upon which Roger, of Parma, so much insisted. All these signs may be wanting although there is a fracture, or on the contrary exist as accompaniments of much less important lesions. Besides it is not the fraction, properly speaking, but the compression produced by it, that justifies the use of the trepan. Whether the effusion be sanguineous or purulent is also as difficult to determine, whilst it is extremely difficult frequently to designate its exact seat. Sometimes, in fact, it is immediately under the point struck that this extravasation is found, sometimes at a point directly opposite, and frequently at some point less distant. The paralysis, which indicates the seat of the affection to be on the opposite side of the head, may be met with on the corresponding side. If the integuments of the head be in nowise diseased, if there be no contusion nor solution of continuity to be observed, it is almost impossible to guess within half an inch, often indeed within several inches, of the exact seat of the collection. The application of a cataplasm over all the head, recommended by some of the ancients, in order to discover the spot where the application is most rapidly dried—a spot corresponding to the disease—is a puerile resource long since appreciated at its just value.

On the other hand, as these affections, even when considerable, have been seen to disappear without trepanning, and as even fractures with depressions of near an inch, of which Physick, Horner, Paillard, Græfe, &c. each report a case, have also allowed of the recovery of the sufferers, without an operation, Desault and his followers, combating the doctrine of the ancients, of Garengeot, J. L. Petit, de Quesnay, Pott, and all the academy of surgery, and returning to the ideas of Van Wyck, Aitkin, and Metzger, have established as a general position that the operation of trepanning is most frequently injurious, and that it should consequently be dispensed with in almost all the cases in which the surgeons of the last century recommended it. This doctrine, supported by the researches of M. Briot, sustained by Professor Græfe, at Berlin, and which the English surgeons have adopted, prevails very generally in France, and has just found an ardent defender in M. Gama. Still some able surgeons, such as M. Larrey, M. Roux, M. Dupuytren, and M. Delpech, among others, have used the trepan successfully at the hospitals of the *Garde Royale*, *La Charitie*, and *Hotel-Dieu*. I know also of a surgeon of *Chauteau-du-Loir*, who performed it some years ago with entire success for a purulent collection, the existence of which was only known by pains and symptoms of paralysis. In 1823, Beclard and M. P. Dubois were

not less happy with a subject affected with fracture without displacement, although they were obliged to take out three circles of bone in the temporal fossa, and to extract nearly eight ounces of blood furnished by the arteria meningea. And in 1825, M. Touissaint reported an instance of success of the same kind, which he obtained by the application of the crown of the trepan six times.

Thus then, without being as prodigal of trepanning as surgeons were before the time of Desault, or without admitting, with MM. Foville and Florens, that it may be useful in relieving the organ from compression in inflammatory or other defluxions of the brain, it would seem that it should be at least more frequently used than is now customary. If it be true that we are often embarrassed in ascertaining the seat and nature of the disease that indicates its use, it is equally true that in some cases the thing is not beyond the reach of an intelligent surgeon. Besides, when it is decided to attempt it, the patients are in such an alarming state, that a simple perforation of the cranium cannot add much to the dangers that menace them. If then we learn in any manner to a certainty, that a foreign body, such as a splinter or angle of bone be the cause of the alarming symptoms, we should trepan; it is even necessary for long standing or consecutive effusions, indicated by necrosis of the bone separation of the pericranium, black color of the neighboring tissues, pale aspect of the lips of the wound, crepitation of the cranial integuments, &c.

Parts of the Cranium that admit of its Application.—The operation having been determined upon, another question presents itself—upon what point shall it be made? It was formerly a rule that the trepan should not be applied above a horizontal line, which would separate the base from the arch of the cranium, passing through the nasal projection, and over the external occipital protuberance; nor over the sutures; nor over the course of sinuses of the dura-mater, the frontal sinuses, the temporal fossa, the anteror-inferior angle of the parietal bones, &c. But Beranger de Carpj, Cortesius, Hoffman, Bromfield, and Pallas, trepanned over the sutures with complete success. Acrel, Wurm, and many others, have perforated the frontal sinuses with advantage. Warner, Marchetti, Garengeot, Sharp, Potts, Callisen, Mosque, and Lassus, have opened various sinuses of the dura-mater, without any unhappy result; and the new experiments of M. Flourens upon animals, tend to prove that this may be done almost without any inconveniences resulting. Carcano and Job a Meckren, had the boldness to trepan over the temporal fossa, without meeting with any impediments from the fibres of the temporal muscle; and Bilguer, Copland, Gooch, Abernethy, and Hutchison have exposed the brain in perforating through the occipital bone. When the trepan is applied over the sutures, and the body to be extracted is found immediately below, then the adhesions must necessarily have been destroyed; but if that be not the seat of the disease, the operation must be performed upon another point. Over the frontal sinus, MM. Larrey, Boyer, S. Cooper, and C. Bell, remark, that to avoid a lesion of the membranes it is sufficient to commence the operation with a crown larger than the one with which you terminate. Besides, what danger is there here of wounding the dura-mater? When the venous sinuses are opened, the hemorrhage, so much dreaded by the ancients, stops of itself, or is easily stopped with simple dressing. Over the protuberances of the cerebellum there are no arterial branches of importance, except

the occipital, and the lesion of the trapezius or complexus muscles is not of much consequence. In the temporal fossa, the division of the muscle, in whatever manner the operation may be performed, will not prevent the re-establishment of its functions. As to the opening of the *arteria meningea*, it will be easy to remedy, either by means of some lint fastened by a thread to the interior of the cranium, as Dr. Physick has done; or by cauterization with a stylet heated white, like M. Larrey; with a piece of cork, a morsel of wax, or a strip of lead, curved in such a manner as to compress both faces of the bone and the groove that encloses the artery, as successfully performed by Dr. Dorsey, of Maryland. Sabatier, renewing the precept of Lanfranc, advises the crowns of the trepan to be placed at the lowest point of the effusion. As it is almost always possible, by varying the position of the patient, to turn the opening of the cranium below; as it is more frequently for the extraction of a solid foreign body than to give vent to liquid matters; and as it is rare that the extent of the seat of the injuring cause is considerable, this precept is less important in practice than it would at first appear to be.

Apparatus.—Hippocrates mentions a scraper, known by the name of *xistre*, with which he scraped the bones to thin them, or to discover the sutures. His trepan was a sort of drill, operating like a gimlet. He speaks, however, of another, which must have had some analogy to the crown more recently described. Celsus gives this crown the name of *modiolus;* without doubt, says Guy de Chauliac, because it resembles a small hogshead (*muid*). He compares the trepan, properly so called, to a carpenter's auger. Galen is the first who speaks of *abaptist* trepans, that is, with crowns or perforators, surrounded by a collar or sheath, which prevented it from penetrating too deep. These *abaptistes*, which are also spoken of in the works of Lanfranc, and a great many other surgeons, have been for a long time rejected from practice. A double convex knife, the gouge and chisel, as well as the *meningophylax*, a sort of blade terminated by a flat knob or button, intended to push the compress between the dura-mater and the bone during the dressing, was employed from the time of Heliodorus and Galen. We find still further, in the work of Andre de Lacroix, the cutting forceps, the punch, and the elevator, as well as the idea of the famous *triploide*, recommended by Scultetus, and of which J. L. Petit has taken pains to show the inconveniences. The agents at present used, and which are commonly placed together in a box, are a trepan, properly so called, with its shaft and its crowns, a punch, a pyramid and its key, elevators, a lenticular knife, a chisel, a cutting forceps, a cock's-comb saw, a small brush, and a leaden mallet.

Operation.—The patient, lying on a bed, having his head supported upon a pillow, below which a plank or metallic plate should be placed, is held in this position by the assistants.

First Step.—The operator, armed with a straight, thick, and sharp bistoury, enlarges more or less in various directions the solutions of continuity, if there be any. If none exist, the operator makes on the integuments previously shaven an incision, the form of which varies with different surgeons. Lanfranc, G. de Chauliac, and Lassus recommend that it should resemble a 7 inverted. Van Swieten, an X; and that the flaps should be excised. At present it has generally the form of a T, or a cross. When operating over the temporal region, cotemporary authors, as Sabatier and Richerand, recom-

mend that it have the form of a V, with the base above, which, according to them, will divide but few of the fleshy fibres. If the summit of the V comprehends a transverse extent of the temporal muscle less than that of the base, the operator must still divide all the fibres comprehended between the two extremities of the latter. It is a long time since circular and triangular incisions, and all those by which the flaps were removed, have ceased to be recommended by any surgeon. Whatever Pott may have said of it, the crucial incision is the one that merits the preference. When there is no fear of sinking into fissures, the bistoury may be carried to the bone at the first cut. The flaps being turned up, covered with fine linen, and held back by the assistant's fingers, the operator has been directed to destroy the pericranium with the scraper. This is a useless and even injurious precaution. The pericranium does not oppose the action of the trepan. The wounding of it with the saw is not more dangerous than that produced by tearing it with the scraper. By making immediate use of the trepan, no more than the necessary circle is torn; whilst with a scraper, it is disruptured always to a certain distance beyond, which necessarily becomes exposed to necrosis. The vascular lines, which even Hippocrates notices as being liable to be mistaken for fissures, will not be effaced by the scraper, especially if they coincide with an abnormal depression of one of the frontal protuberances, and are somewhat deep, as I have recently seen them at *La Pitie*. It will evidently be of no assistance in distinguishing a true fissure from the lateral suture, sometimes observed on the parietal; from the deviations of the sagittal suture, mentioned by Van Swieten and Quaisnay; or the accidental disposition of the wormian bones, which failed to deceive Saucerotte. Still, if the operator desire to use this instrument, he takes it in the right hand by the handle, with the plate between the thumb and index finger, handling it in such a manner that it shall neither leave any part untouched, nor denude more than is desired.

Second Step.—When the *trephine*, which the English almost exclusively adopt, is used, and of which M. Withusen has recently become the advocate in Germany, the surgeon, holding it in his hand by the handle, makes it act like a gimlet or cork-screw. If, on the contrary, the *trepan* be preferred, the crown is placed on it, and then, taking hold of the stock with the right hand as if holding a pen, the operator places the point of the pyramid upon the centre of the piece of bone to be removed; presses upon the crown to mark this point, whilst the other hand supports the rest of the instrument; then removes the crown, and puts in its place the perforator, the summit of which he puts in the point marked by the pyramid; embraces the ebony plate that terminates the handle of the trepan circularly between the thumb and index-finger of the left hand; presses upon this plate with the chin or forehead; takes hold of the shaft of the trepan with the right hand; gives it two or three turns from right to left; puts the crown in place of the perforator; takes hold of the instrument as when first using it; fixes the pyramid in the hole just made, and turns it again as just stated, taking care to press equally on all the teeth of the saw, in order to form the circular groove as regular as possible. When this groove has been made deep enough to prevent the crown from escaping from it, the pyramid should be removed. Otherwise it would render the operation longer and more dangerous; reaching below the level of the crown, it would necessarily reach the membranes before the completion

of the section of the bone. The trepan having been again placed in its groove, the surgeon should use it rapidly, inasmuch as it is still at some distance from the dura-mater, withdrawing it from time to time to see if the section be regular, to clear the teeth with the brush, and also, as Hippocrates remarked, to prevent its becoming too much heated; when it has passed the diploe, use it gradually more slowly; from time to time attempt with the elevator or other suitable piece of metal to move the osseous disk formed by the crown, and cease entirely from using the trepan as soon as a certain cracking noise is heard, which it will be impossible to confound with any other sound when once heard, and which indicates that the operator has reached the membranes. When the osseous plate is completely divided, it sometimes comes away with the crown of the instrument. In other cases it is removed by an elevator of any kind, used as a lever of the first class.

Third Step.—If the section be regular, it is useless to apply any other instrument; but if there be left in its deeper parts any points or sharp scales, it will be proper to apply the lenticular knife, placing the button between the dura-mater and the bone, passing it, edge foremost, entirely around the circumference of the orifice in the bone. If it be the seat of the disease, the matter begins immediately to be discharged. If there be a foreign solid body, it is to be seized and removed with the forceps, or any other appropriate instrument. Sometimes we meet with an effusion extending some distance from the point on which we have operated, and if it consist of coagulated blood, or other plastic matter, a single perforation is insufficient for its escape. Then there should be no hesitation in applying the trepan a second, or even a third. The destruction of a considerable portion of the arch of the cranium should not excite alarm when it is necessary. Solingen says that the Prince of Orange bore seven applications of the trepan without inconvenience. Spigel reports a similar case. V. D. Wiell speaks of one on whom it had been applied twenty-seven times; and, as before stated, M. Toussaint communicated a case to the academy, in which he used it six times. Besides, every one knows the facts cited by Blegny, Saviard, and de la Vauguyon, in which almost all the arch of the cranium had been removed without destroying the patients. Many of the Strasbourg theses contain not less remarkable cases.

Remarks.—When several circles of bone are removed for the simple purpose of obtaining a large opening, it is not now customary to leave between them bony bridges, which it is subsequently necessary to remove with the chisel, as Hippocrates, Helidorus, Celsus, and many of the surgeons of the middle age did. The operator should remove them in such a manner that the circumference of one should reach as nearly as possible to that of the other; so that if there remain between any more or less projecting angles, they may be easily removed with the cutting forceps. If a new perforation is to be made because the first did not fall upon the effusion or foreign body, it is a second operation in which the operator must conduct himself as above directed. When the seat of the disease is found immediately below the circle, there is no need of dividing the dura-mater; but when the extravasated fluids are more profound, since the time of Glandorp, we do not fear to incise that membrane. It should, however, be done only where we have good reason to think that we shall strike the seat of the disease; that is, when we observe a

blackish, livid, or yellow tinge, and a greater or less projection of the external meninges. This division is to be made by a bistoury held perpendicularly, commencing at one extremity of one of the principal diameters of the opening, and carried to the other extremity without going any deeper. It has also been recommended, that when there exist no fluids between the membranes, to incise the substance of the brain. Authors cite on this subject a certain number of facts; among others, a case observed in the practice of M. Dupuytren, in which he did not hesitate to sink the bistoury more than an inch deep into the brain; such conduct must be but rarely imitated. When the effusion has its seat in the cerebral substance, how shall we know where to find it? Is it not then almost always the effect of an internal cause? By what sign are we to recognize its presence, even when it corresponds with the opening of the bone? Without doubt, a simple puncture of the brain, even very deep, may possibly not produce death, or even any other than the slightest consequences; but, on the contrary, as it is equally possible that it may, it will always be with trembling that a circumspect surgeon will decide to injure thus the substance of the encephalic organ. In some cases the effusion is separated into different portions, by bridles, adhesions, or partitions. If this condition be suspected, the operator must not be content with one circle, but remove two, one on each side, as has been recommended when operating in the neighborhood of sutures, or in the course of the sinuses. When trepanning for the extraction or elevation of a fracture or splinter, the operation requires some peculiar modifications. First, the point of the pyramid must be applied upon the edge of the bone that offers the most solidity, and the crown made to cover both sides of the fracture at the same time. Then, when the effusion is removed, the attention must be turned to the splinters or depressed fragments of the bone. All that is proper to be removed should be detached with the pincers, cutting forceps, or, if necessary, with the chisel, or gouge and mallet. To elevate parts which are simply depressed, recourse may be had to levers of different forms. Neither the tripod of the ancients, the triploïde elevator of Scultetus, nor the instrument similar to a cooper's piercer, is any longer in use. The elevator, with a bridge proposed by J. L. Petit, and the same instrument modified by Louis, are also rejected. All operating surgeons use the simple elevator, with a steel stock about six inches long, curved in the form of an italic *S*, with a rasp-like roughness on the concave face of its two extremities, which extremities are flattened like a chisel. It would even be possible to substitute an ordinary spatula for this instrument. Often, when there is a fracture, we may, by introducing a chisel or some other instrument into the fissure, produce a separation of the bones sufficient to allow the escape of the fluids, and thereby render the application of the trepan, properly speaking, useless. In fractures with considerable separation of the edges, and in simple fractures of the sutures, of which M. Robert and M. Goubert have each published a remarkable example, observed in the adult, the cranium should not be perforated unless the fluids are extravasated under some other point.

The Dressing is much more simple now than formerly; there is no further demand in practice for the oils, tinctures, balsams and ointments, of which the ancients were so prodigal. The sieve-like plate of gold of Auck, and the plate of lead, recommended by Belloste, are also obsolete. The operators of the present

day content themselves with a disk of fine linen, pierced through the centre th a thread, which is to keep it out, and which is carefully placed between the dura-mater and the bone, by means of the meningophylax, of a spatula, or of a simple probe-pointed stylet; nay, even this may be replaced by a small fine compress, covered with cerate and pierced with holes. The middle part should be sunk into the opening in the bone, and the rest made to cover the internal everted face of the flap and all the wound. The excavation or purse resulting, is to be filled with rough charpie or lint, which should be covered by one or more pledgets. Some compresses are then placed over these, and the whole supported by a bandage, which the surgeon sometimes applies in one way, sometimes in another; or by a simple triangular kerchief, the *couvre-chef* of Galen; or, still better, an ordinary cotton cap; or, as Heliodorus has recommended, a netting of hair, which the Spaniards employ under the name of reddizella, and which is used among us to cover the heads of young girls.

Mynors and M. Maunoir direct that no part of the dressing shall be introduced into the opening of the skull, and that the integuments be brought together and held in contact by adhesive strips. Blount and Herlich, who give the same advice, are said to have put it in practice successfully. Others have gone still further. Job a Meckren speaks of a person, in whom the morsel of bone had been replaced by a similar piece taken from the head of a dog. M. Maunoir thinks that we might thus close the opening from the trepan. It even appears, according to Richter and Walther, that this strange transplanting operation has been attempted in Germany, not without some success. For my part, it appears evident to me that the approximation of the edges of the wound will not prevent the effusion of a certain quantity of fluids between the dura-mater and hairy integuments; besides, we must most frequently desire to preserve the solution of continuity open, to give vent to the extravasated fluids, and room for the detersion of the diseased parts. As to M. Maunoir's idea, it belongs much more properly to the history of *animal engrafting* than to trepanning.

The sequel of trepanning requires no attention which it will be very difficult for the patient to obtain. The dressings should be renewed every day once or oftener, if the abundance of the discharge appear to require it. When the suppuration has dried up, the cerebral affection has disappeared, and, in fine, when there remains nothing more than the wound from the operation, the surgeon then occupies himself with its cicatrization, which he should do by endeavouring to bring together the edges, and treating it as any other simple wound. This cicatrization presents some peculiar phenomena. Sometimes the circumference of the opening of the bone becomes thinner, and seems to approach the centre, to confound itself at last with the dura-mater and integuments of the skull. At other times, especially when the opening is very large, the edges become blunted or rounded; some cellular sprouts, shooting up from the fibrous membrane of the brain, gradually fill the opening, become more and more solid, and ultimately unite with the exterior soft parts; forming in reality a stopper or plug, of which Duverney preserved a very pretty example. After the cure there generally remains a depression over the cicatrix, of which M. Serre has reported three examples, the thinness of which sometimes permits the movements of the brain to be seen

externally. It has also been recommended, in order to prevent cerebral hernia, to keep a convex disk, or plate of lead or other metal, over the depression just spoken of. To enforce the necessity of this sort of plate, Monro reports the case of a young girl, who thought she might dispense with one she had worn for a long time, and who was soon after taken with a cerebral affection, of which she died at the expiration of five days. As the metals become easily charged with a great quantity of caloric, it has been feared, and especially with those forced by their social condition to remain exposed to the rays of the sun, that they might occasion some serious consequences. Now their place is supplied by pieces of leather or the like, which are placed like the pads of a truss.

If a necrosed speculum, or part of the bone remain fastened in the healthy parts, so as to resist the action of the forceps, as has sometimes been observed, it should, at the instance of J. L. Petit, be entirely uncovered, isolated by some strokes of the chisel, raised up, and extracted with an elevator or some other instrument. In young children, the cranium is so thin that it may be perforated by scraping it with a piece of glass; or better, with a scraper, as many authors recommend. The cock's-comb saw, one of Hey's little saws, should take the place of the crown, if it be only required to remove some projecting angle of the edge of the fracture. If the necrosis should not comprehend all the thickness of the bone, or if the seat of the disease be between the two tables of the skull, the scraper and the perforator will, without doubt, be sufficient, and the surgeon will take care not to penetrate to the dura-mater. But whenever the disease extends to the membranes, it will be dangerous to follow the advice of Hippocrates; namely, to leave at the bottom of the opening an osseous lamina as thin as possible, and depend on its exfoliation for the opening of the passage for the escape of the effused fluids. I would finally add, that in some cases detergent injections, or any other kind suited to the indications, will serve to hasten the modification of the pathological cavity, as well as the rest of the wound, and that there may be some inconvenience from neglecting to employ them.

CHAPTER II.

The Thorax, Pelvis, and Extremities.

Next to the cranium, the thorax is the part of the body on which the trepan has been most frequently applied. The father of medicine used it, by applying it over a rib to open an abscess. It was with the trepan that Galen removed the carious sternum of a young man that had been injured in wrestling, and in which case he was obliged to penetrate to the pericardium, which was itself injured on its anterior face. Avenzour, Friend says, recommended trepanning the sternum, not only for abscess of the mediastinum, but also for that of the pericardium. V. D. Wiell performed this

operation successfully for a large purulent collection. Colombo, Salius, Diversus, and Junker, formally recommend it. Pauli and Solingen say that Purman found it very useful in two different cases; J. L. Petit followed their advice. According to Sprengel, Bœttchen recommended its application to fractures of the sternum, in order to open a way to the elevation of the pieces of sunken bone. To impress the advantages of it in this case, *de la Martiniere* reports that a soldier, wounded at the siege of Philipsburg, in 1734, was perfectly cured, after having had four large bony plates, comprehending the whole thickness of the sternum, removed. Mesniere, of Angouleme, was equally successful with a young patient, who had had this bone broken across. Almost all the carious portion was removed with a large crown, and the asperities of the opening were removed with the lenticular knife. Alny followed the example of Wiell, on a coachman to the king, who had been a long time affected with an internal abscess, that had opened at the neck. Sedillier treated a young woman, aged twenty-two years, in the same way, who, as a sequel of an abscess produced by a blow upon the thorax, was afflicted with fistulous ulcer, through which he could penetrate without difficulty into the mediastinum. The carious sternum was found to have concealed a purulent collection, and the patient was cured in two months. A male adult, in whom an internal abscess had made its way to the exterior, between the two first pieces of the sternum, was admitted into the hospital of Rouen, in 1754; Lecat enlarged the opening in the integuments, scraped the face of the bone which had been altered by caries, and a few days after applied the crown of a trepan, which enabled him to convey into the abscess such medicines as were necessary to the detersion of its walls. Ferrand, of Narbonne, did not fear in a similar case, although much more complicated, to remove a great part of the same bone with the trepan, and many of the cartilages of the ribs with a small saw: his patient recovered. In fine, it was with the same success that Auran treated a simple caries of the sternum. It is very true that in this last case the actual cautery has more than once advantageously replaced the trepan. The fact related by Aymar, of Grenoble, is a conclusive proof of it; but Marchetti remarks, that according to his own experience cauterizing the neighbouring parts may be very dangerous, and that it frequently fails of producing a separation of the dead bone. In support of his assertion I could, if necessary, appeal to a late case in one of the hospitals of Paris. The cautery was applied, the necrosis did not exfoliate, and the subject died from the progress of the disease. We may then, with De la Martiniere, assert that the trepan is a valuable resource in necrosis of the sternum, whether this necrosis may or may not be caused by some external lesion, or whether it do or do not cover a purulent collection.

The Method of Operating is governed by the same rules as those applicable to the perforation of the skull, whether using the crown, the perforator, Hey's saw, the scraper, or any other part of the apparatus; only the density of the bone being less, it is infinitely easier to penetrate into the thorax than into the cavity of the skull. The internal mammary artery cannot be touched, unless the disease makes it necessary to apply the instrument without the edges of the sternum. In his first patient, de la Martiniere saw it so completely isolated, that he thought it right to keep it enveloped in charpie for some weeks. In another case, the hemorrhage to which it gave rise was

arrested with simple styptics. I shall say nothing of trepanning, proposed by some persons for the purpose of getting at the envelope of the heart in pericarditis; nor of that which has been proposed, to enable us to reach the trunk of the innominata for the application of a ligature, because I have said elsewhere what I think of them.

The Scapula.—There are some other large bones that may be easily trepanned. A soldier received the thrust of a foil through the shoulder. The wound remained fistulous. An ulcer formed in the subscapular fossa, and the pus could only partially escape by an opening in the scapula. Marechal decided to apply the crown of a trepan over this bone, and by it the patient was promptly cured. Else, of London, proceeded in the same manner for a simple necrosis of this bone, and was equally fortunate. Boucher also professes to have trepanned the ischium, for the purpose of evacuating an abscess of the pelvis; and, according to Sprengel, Bilguer is believed to have done the same to the os coccygis.

The Spine.—Even the vertebral column has not escaped the application of the trepan. Mr. Cline first, and then Mr. Tyrell, have each tried it upon the rachidian groove, for the purpose of extracting either splinters or blood, compressing the cord, but the patients died a short time after; and I can scarcely believe that a surgeon can meet with indications sufficiently precise to justify the repetition of these attempts with any expectation of success.

The Long Bones.—I have already said that the trepan and gouge are frequently used for removing some parts of the long bones. Boyer many times made use of it, towards the last of the seventeenth century, to arrest a caries of the tibia. It is principally in encased necrosis that it is of much assistance. When an exfoliation of a certain extent forms and becomes loose in the body of the tibia, femur, humerus, &c., some fistulas may open from it outwardly, but, if left to its own exertions, the system can rarely accomplish its expulsion. With the assistance of one or more crowns of the trepan, placed opposite to each other over certain points of the new osseous sheath that envelopes it, and a few strokes of the chisel to break up the bridges left between the crowns, the operator may expose the exfoliation near one of its extremities in such a manner, that with a pair of strong forceps he may extract it entire. It is an operation that M. Dupuytren has often successfully performed at the Hotel Dieu, and which many other surgeons have also extolled. But more ample details on this subject belong to the chapter on *Excisions;* and all the other cases of trepanning not found here, will be spoken of under the head of the special operations of which they form a part.

SPECIAL OPERATIONS.

PART I.—OPERATIONS ON THE HEAD.

CHAPTER I.

CRANIUM.

1. *Fungous Tumors.*—The ligature, cauterization, or excision of fungous or sarcomatous tumors of the dura-mater, would evidently only hasten the death of the sufferer. Extirpation, the only rational remedy, appears itself to be but rarely followed with success. In fact, the external tumor is often but the least part of the disease. After removing it, the operator soon sees it reproduced, perhaps under a new form. In a word, they have the common nature of cancerous tumors of all other parts of the body; but not being able to present themselves in any other way than through an osseous opening, it is not possible, as in the latter case, to define, as they advance, their exact limits. Nevertheless, I cannot see why we should not attempt to extract them, when every thing indicates them to be circumscribed, and the disease itself strictly local. In a woman, cured of a cancer of the breast, who died of a pleurisy at the *Hopital de l'Ecole*, in 1824, a scirrhus tumor of the size of a pullet's egg, growing from the dura-mater, had crossed the right inferior occipital fossa, made a slight projection under the splenius muscle, and was so regularly circumscribed, that it certainly would have been possible to have removed it entire, if there had been any suspicion of its existence during life. The operation might be attempted at least for the fungous tumors of new-born infants, to which Mr. Neagle was one of the first to call the attention of operators, as well as those which Mr. Abernethy makes to proceed from sanguineous concretions or diseased lymphatics.

Method of Operating.—The operation in itself has nothing remarkable. After shaving the head, the surgeon makes a crucial incision of the scalp, dissects and turns back the four flaps, so as to expose the tumor to a certain distance from its base; makes use of the lenticular knife to enlarge the osseous opening, if he finds its edges thin—should he, however, make use of the trepan, he will apply it successively at several points around the disease, so that he may reach even beyond its limits—returning to the lenticular knife, or using the gouge and mallet, he destroys the angles left by the trepan; then, with the point of a bistoury, he makes a circle on the non-affected portion of meninges; extirpates and removes the whole morbid mass; and then follows in the dressing the rules laid down for the same stage in simple trepanning.

2. *Osseous Tumors.*—Exostosis of the external table of the skull bone rarely produces consequences serious enough to induce the sufferers to apply for its removal. But it is not so if they comprehend the whole thickness of the bone, especially when they jut inward and compress the brain. In the first case, after having uncovered the tumor, a small saw, the chisel, or the gouge and mallet, and then the scraper, will suffice to remove it; in the second, the trepan will be indispensable to isolate it at its circumference and permit total extirpation.

3. *Encephalocele.*—There is no other remedy for a hernia of the cerebrum, or cerebellum, than a bandage supporting an elastic cushion or ball, properly applied. All kinds of bloody operations are dangerous, and might probably produce death, as in the case published by M. Lallement, of the Salpetriere.

4. *Lupia.*—Many persons all their lives carry steatomatous or melicerique tumors under the hairy scalp, without being sensibly incommoded by them, or desiring any attempt to remove them. Others suffer more or less from them, and for one reason or another wish at all hazards to be rid of them. The nature and formation of these tumors are still imperfectly known, and seem to me to require new researches. At the commencement, there are some which present the appearance of a small mass, hard, yellow, friable, not organized, similar to a mass of fibrin, or of blood deprived of its coloring matter and serum. Whilst growing they soften, commencing at the centre, and thus transform themselves into a cyst, filled with a substance more or less fluid, which resembles neither pus nor fat. May we not attribute their origin to some of the constituents of the blood extravasated? It is at least certain that they are not distended cutaneous follicles, as Beclard and S. Cooper assert. If it were desirable, the ligature might cause them to fall off, of which Boyer relates an example, although it is rare that they can be strangulated at their base. Bertrand is said to have cured them by passing through them a long needle, which he retained like a seton. But a cutting instrument is infinitely better, and should be preferred in every case.

Operation.—When the tumor is very voluminous, and the skin greatly attenuated, an elliptical flap of the teguments should be removed with the cyst. Two semilunar incisions are then first made. A transverse incision is then made outwards from each lip of the wound, so as to form four flaps, which being turned back with care, allow of the removal of the entire tumor without difficulty. Most frequently the last two incisions mentioned may be neglected. Whilst with a hook or a good pair of forceps the surgeon draws the cyst with one hand, with the other he dissects its external face carefully from the neighboring tissues with the point of the bistoury. In the ordinary method, and when it is not necessary to sacrifice any part of the skin, a simple crucial incision, or T, is recommended; and every possible caution is to be taken not to open the cyst whilst dissecting the flaps, which are to be reunited immediately after the extirpation of the tumor.

Sir A. Cooper pursues another method. He first opens the lupus freely; empties it by compression between the fore-finger and thumb; then seizes the cyst with a crotchet or forceps by one of its edges, dissects it, and takes it away. An incision being made in such a manner as to leave the posterior wall of the meliceric purse untouched, M. J. Cloquet immediately lays hold of the

anterior wall under the right lip of the incision with a pair of forceps, draws it towards him as he divides its adhesions, which are generally slight, and operating, as it were, with a single cut, removes the whole cyst. I have more than once been contented with merely dividing the integuments, then thrusting to the bottom of the wound a strong hook to lay hold of the tumor, after which it is easy to dissect and remove it. By these three steps of the simple method, the operation is rendered much more prompt and less difficult than by the ordinary method. After the removal of the cyst the edges of the incision bring themselves into contact, and reunion is generally effected in a few days.

Hydrocephlus.—The only operation that has been proposed for hydrocephalus is puncturing the cranium. Holbrook and Vose pretend to have practised it, or seen it practised, successfully. Bossi took, in this way, at several times, six pounds of serosity from the head of a child of eleven or twelve years of age, who was ultimately cured. Mr. Lyme had recourse to it in 1826, five times on one child in the space of some months, and each time with some appearance of benefit, but the little sufferer ultimately died. *The Lancet* states that Mr. Conquest succeeded with it twice, and Mr. Geatwood once. Sir A. Cooper seems to have been partially successful with it. M. Bedor, who has tried it, also believes in its utility. But the disorder of the brain produced by hydrocephalus, is commonly too important to be removed by simple puncture. Still, if the operation be decided upon, nothing is more easily done, with either a lancet, a bistoury, or a trocar. No other precaution is necessary than to take care not to injure the venous sinuses. If the operator does not desire at once to evacuate the whole of the fluid, I think it better to repeat the operation from time to time, than to leave a canula remaining in the wound, according to the proposition of Lecat.

CHAPTER II.

The Face.

SECTION II.

The Nose.

Art. 1.—*The Rhinoplastic or Taliacotian Operation.*

History and Appreciation.—In Italy and India it was once the practice to cut off the noses of criminals. It was thus that Sextus the Fifth treated thieves and robbers, and the king of Ghoorka the inhabitants of Kistipoor, even when infants at the breast, in order, as he said, to know them anywhere, and to be able to apply to their city the name of *Nasicatopoor.* In all countries persons have been known to cut it off themselves to avoid pursuit, or to tear it from others to gratify the desire of revenge. Charles II. thought he could not inflict a more cruel punishment on the Chevalier de Coventry, who had dared to speak lightly of two actresses kept by his king. Frederick II. treated a certain noble in the same manner, that complained with insolence of having been

enrolled by fraud. At the approach of the Danes, a great many women and young girls amputated it themselves, for the purpose of saving their honor. An abbess and her forty nuns also made use of it when the Saracens presented themselves before Marseilles. Who does not recollect the history of the wife of a notary at Paris, who, out of revenge, cut off the nose of another man's wife, of whom she was jealous? When we add to these strange mutilations, those which depend on unforeseen accidents, those produced by small-pox, syphilis, cancer, scrofula, freezing, burning, &c., it will be seen that an occasion to supply the loss of the nose may present itself quite frequently. The hideous aspect of those who have had the misfortune to lose this organ, must soon create a desire to correct as much as possible so repulsive a deformity. Galen, Aetius, and Celsus speak of the art of mending the nose in their time; but it was not until about the fifteenth century that the rhinoplastic operation took its place among the regular efforts of surgery. P. Ranzano says that the Brancas, father and son, surgeons of Sicily, who lived in 1442, practised it very successfully. Boiani, Celestius, Benedetti, and Bernard treat of it as a customary remedy. G. Tagliacozzi, who died in 1599, acquired such celebrity from this operation, that a statue was erected to him in the anatomical amphitheatre at Bologna. Mercurealis, Fyens, Fallopius, Vesalius, Read, and Gourmelin, speak of the art of restoring the nose. According to F. de Hilden, Griffon of Lausanne, was a very able *nasifex;* and Ambrose Pare says that the court of Henry III. was astonished at the appearance of the Chevalier de Thoan, after his return from under the hands of a nose-mender of Italy. Yet, notwithstanding these testimonials, to which may be added that of Cortesius, Molinelli, Dubois, Garengeot, Rosenstern, Moinichen, Leyser, and of Fioraventi, who replied to the incredulous of his time, "Go visit the Seigneur Andreas, living at Naples, where every body knows his history, and he will tell you that, happening to be at the place at the time of his accident, I picked up his nose that had fallen in the dirt, washed it in warm water, and replaced it as well as I could. Examine this nose and cicatrix well; listen to what will be told you, and then see if you can doubt any longer a fact so well proven." Notwithstanding so much testimony, I say, it was scarcely admitted amongst us as possible to form a new nose, when the work of Dr. Carpue, published in 1816, put the matter beyond further dispute. A Mahratta, who served in the English army, was taken prisoner by Tippo-Saib. This prince ordered his nose to be cut off. Having returned to his comrades, Cowajee (the name of the sufferer) excited the pity of a Hindoo, who refitted a nose in the presence of T. Cruso and Finley, physicians of Bombay. Pennant made known another case of the same kind, in 1798; and Sir C. Makes affirms that this operation is common all over the East Indies, where Mr. Lucas says that he performed it about the time of Hyder-Ali. These facts being transmitted to London, attracted the attention of Messrs. Lynn, Carpue, and Hutchison, who immediately set themselves to examine into the origin of the Indian operation, and the advantages that surgery might derive from it. Dr. Carpue performed it twice with success. M. Græfe also paid attention to it, and made known the result of his experience, in 1818. Soon after, some essays of the same nature were made in France, by MM. Delpech, Dupuytren, Moulaud, Thomasin, Lisfranc, and Blandin. In fine, Travers, Liston, and Green, in England; Dieffenbach and Beck, in Germany, have also endeavored to diffuse the art of repairing the nose

Upon consulting the writings of Tagliacozzi, Dr. Carpue, and Professor Græfe, we will be forced to admit that, in certain cases at least, the new nose does not differ as much as might be expected from the original. One of the patients operated upon by M. Delpech, and who has been seen in Paris, had not much cause for complaint after this repair. I have seen the subject whose case M. Lisfranc published, and I must say, that in him the new nose was far from presenting all the regularity desirable. On the other hand, it must not be forgotten that at Paris particularly are to be found false noses, made of plates of silver, copper, pasteboard, and even wax, which may be so applied to the face by means of springs, or by securing them to spectacles, which is still better, that the deformity is almost entirely removed. M. Boyer speaks of a patient in whom, at first sight, the deception was not perceptible. Yet a metallic nose will never permit the wearer to blow it, take snuff, or to use the olfactory function as freely as the mended one.

1. *The Italian Operation.*—1st. *Tagliacozzi's Method.*—Although in Sicily and Calabria there appears to have been many methods, there is one particularly superior to the others, which appears to have been generally adopted: it is that of Tagliacozzi; the only one spoken of in Europe until recent times. The surgeon begins by forming a nose of pasteboard, or of wax, upon the arm of the patient; applies its anterior face to the nares; applies it again to the arm, with its point towards the shoulder, at some suitable spot, and marks the circumference with ink; then circumscribes a triangular flap of skin, which he dissects from its point to its base, by which it is left adhering. A strip placed below brings together the lips of the wound. After some time the operator pares off the edges of the deformed nose, as well as that of the tegumentary piece of the arm. Nothing further is then necessary but to bring the bleeding edges of the two together by means of sutures, and to fix the arm in front of the face by means of an appropriate bandage. Some rolls of linen are also placed in the anterior opening of the nostrils. When reunion has taken place, the surgeon divides the base of the flap which remains on the face, and makes the lobule of the new nose. Others are content to make an incision in the fore-arm, in which they fix the denuded edges of the mutilated nose until it has contracted intimate adhesions with the skin. Then they have only to cut and separate a triangular flap on each side from the arm, unite them at the median line, and thus leave a sort of rapha on the nose.

b. M. Græfe's Method.—In M. Græfe's method the patient begins by putting on a laced jacket, which covers a capuchin or cloak and hood, which firmly embraces the head. One of the sleeves of this jacket is open before, and has, near the elbow, four leather straps, and two others shorter near the wrist. The operator makes raw the openings of the destroyed nose; measures it, like Tagliacozzi; marks out and cuts a flap in the same manner; secures the arm thus prepared by means of the straps above mentioned, and to keep the denuded edges of the mutilated nose and the flap in contact makes use of needles and the twisted suture. After from four to thirty days, the union will have been completed. The bandages may be then removed, and the flap detached. After it has once been secured to the nasal partition, two openings may be made similar to the natural openings of the nostrils, in which the end of a gum-elastic sound should be placed until the parts have

completely cicatrized. M. Græfe is the only person who has followed—though he has modified it—the Tagliacotian method; by which he has, he says, succeeded four times out of five.

2. *Indian Methods.*—It appears, according to M. Dutrochet and the above mentioned authors, that there are three kinds of rhinoplastic operations in India.

a. By means of a Cutaneous Flap from the Rump.—In some countries when a mighty personage has lost his nose, he procures a slave, whose rump is to be slapped violently with a slipper until the integuments become swelled. A *nasifex* cuts a flap, of a form and size sufficient to replace the lost nose, from this singularly prepared part; applies and fixes it firmly to the nares, which he keeps open by means of a small cylinder of wood. There is every reason to believe that this method has been more than once put in practice. It is, in fact, but a modification of the Italian method, using the skin of another part of the body. Van Helmont, in speaking of it, says that a nose formed in this way mortified suddenly at the end of a year, because the man from whom it had been taken died at the same moment.

b. By Transplantation.—In the country of the Parias the nobles do not hesitate to clip off the nose of one of their subjects, and put it in the place of their own, when lost. They succeed so well in this way, say the travelers, that, to prevent criminals whom they have just punished from repairing their deformity, they take the precaution to throw their nose into the fire as soon as it is lopped off. This is a method of which they were not ignorant in Italy, as is proved by the above extract from Fioraventi Molinelli, who affirms that his father, having received the nose of an Italian in a warm loaf of bread, was enabled to readjust it a little while after the execution of the sentence; and Leyster says as much of a young man of a high family. Dionis tells that a robber, having had his nose cut off, ran to a surgeon, who demanded of him the end of the organ that he might reset it. His comrades went back and brought it warm to the surgeon, who applied it, and the fellow recovered. In a quarrel a soldier bit off the nose of his adversary, and threw it in the mud; the wounded man picked it up, and in full pursuit of the one who had done him the injury, threw the nose into the stall of M. Gallien, who cleansed it with some warm wine. The soldier returned, says Garengeot, the nose was reapplied and secured, and cicatrization took place. So that those observations, that have during a century drawn forth injurious sarcasms on their authors, may not be altogether apochryphal. In 1742, Dubois being applied to by a man, the end of whose nose was held by only a thin pedicle, brought the parts together, and thus obtained, to his great surprise, union by the first intention. M. Boyer attended a young man, the cartilaginous portion of whose nose had been almost entirely cut off, and the pedicle supporting it was scarcely a line broad. This surgeon attempted to produce reunion, and succeeded quickly and completely. Besides these, there has been invoked in support of these transplantations the testimony of Aulaus, who saw the flesh of a living fowl employed successfully for the cure of a hare-lip; of T. Bartholin, who says that a sailor was promptly cured of a wound with loss of substance, in the hypochondriac region, by the application of mutton, which soon adhered and grew. The experience of Baronio, of Milan,

contradicted, it is true, by that of Huzard and Gohier, but strengthened by that of Duhamel and Hunter, proving that the skin from the sides of an animal, transplanted from right to left, or applied in the same situation upon other animals, adheres and continues to live. The case of the young men of the north of Germany, who, as an evidence of their intimate friendship, exchanged with each other a flap from the anterior face of the fore-arm; and finally, those cases of complete separation of the fingers from the hand, reported by Heister, Pouteau, Thompson, Bayley, M. Lespagnol, M. Wigorn, Balfour, and many others, cited by Percy, &c., go to establish this point. If it be admitted that many of these cases should be numbered among the stories of old women, it is difficult to have any doubt of the numerous and well-authenticated cases, recently related by Hoffaker in Germany, Piedagnel, Berard, junior, and Barthelemy, in France; cases in which portions of the nose, ears, lips, fingers, &c., have been seen completely or almost separated from the living tissues, re-applied to the wounded surface, contract adhesion and reassume vitality. The six examples of Hoffaker epsecially, leave not the least doubt in this matter; and M. Layraud saw a man whose two middle fingers, cut by a single stroke so nearly through that they held but by a small strip of skin on the palmar face, were yet perfectly recovered by being brought into reunion, and held so by small splints.

c. With the Skin of the Forehead, or the Method of the Koomas.—By the method generally preferred in England and France, the surgeon commences, as in the preceding, by forming a nose of wax or pasteboard, which he then spreads upon the forehead with the point downward. Its circumference is marked with some coloring matter. The operator then dissects the flap thus traced, taking care to leave at its base a small prolongation destined to replace the nasal partition; turns it downward by detaching it as low as the malar bones; twists the pedicle so that the cuticular surface of the flap may be outwards; cuts and regulates the form of the nares; unites their bleeding edges with those of the flap; secures them in contact by means of a composition of *terra japonica*, or by the suture; brings down the middle pedicle upon the upper lip, and fills the openings of the new nose with small compresses rolled into cylinders, pieces of the barrels of quills, or gum-elastic sounds.

Remarks.—The East Indians scarcely ever use the suture. Dr. Carpue preferred it; and M. Delpech, who performed the rhinoplastic operation twelve times, says that it should never be neglected, and that the twisted suture should be preferred. Tagliacozzi has well remarked, that the skin, once separated from the parts which kept it extended, contracts, and that it is important to give the flap a greater size than seems necessary for the new organ that it is about to form. The wound of the forehead, at first very large, contracts rapidly, and leaves a cicatrix much smaller than would be expected immediately after the operation. Blandin also pursued this method with the two patients on whom he recently operated. The one I saw has done very well. His nose is somewhat large and round, but not much deformed, firm, and of a very regular continuity with the forehead, as well as with the cheek, by two grooves, the right of which being deeper than the left, gives it an evident inclination in that direction. Instead of dividing and excising the pedicle after adhesion has taken place, M. Blandin denuded the root of the flap, and united it with the wound of the nose, which he pro-

longed upwards by loss of substance for this purpose expressly. In this manner the circulation was never stopped, and the form of the new organ became more regular between the two orbits. His second patient, although attacked with erysipelas and delirium, was finally cured, and has a nose still more regular than the first. M. Lisfranc contented himself with adhesive straps instead of sutures, in the case of his first patient, Eval. In order to lessen as much as possible the effect of the twisting of the flap, he extended its apex three lines lower down on one side than the other; and also, to avoid cutting the pedicle at a later period, he united it by two lateral incisions made on the sides of the natural nose. Uhion took place at first only on one side, and the suture became necessary on the other. In one case treated by M. Lisfranc, everything announced a happy termination, when another disease, foreign to the operation, put an end to the hopes of the surgeon.

4th. *French Method.*—M. Dieffenbach's operation consists rather in the mending of the nose than the formation of a new one. He dissects up and fashions the sides from the mutilated nose, places small flaps or strips, which he gets from the neighborhood, between them to fill up the void, and then unites the whole together by fine needles and the twisted suture. The passages in Celsus, Galen, and Paul of Egina, apparently relating to the rhinoplastic operation, indicate, I think, this method of operating. It was also on different parts of the face that they sought flaps to cover the denuded parts. Celsus even says, that if the operator takes the precaution to make long vertical incisions near the ear, it then becomes much easier to bring the skin towards the median line. It was by making use of the neighboring tissues that Franco succeeded, as we shall see further on, in restoring the cheek of one of his patients. We may add, that one rhinoplastic operation of this kind, performed in 1820, by M. Larrey, was entirely successful; and that the soldier was presented to the faculty of medicine, when I had an opportunity of examining him. Among his cases, M. Dieffenbach insists particularly on that of a young girl, in whom the vomer, ossa malarum and vertical lamina of the ethmoid bone had been destroyed by scrofula; whose nose, instead of being convex, was so sunken as to present a hollow. Many incisions, much nearer one another on the side towards the forehead than on that towards the upper lip, permitted him to bring out this semblance of a nose, and also to raise up its sides. Other transverse or semilunar incisions facilitated the union of the bands made by the first incisions, whilst a small flap was borrowed from the lip to form the partition. Several needles were afterwards applied in various directions, and by the assistance of some small patchings, which several accidents rendered necesssary, M. Dieffenbach ultimately succeeded in giving to the nose of this patient a passable form and regularity.

5th. *Relative Value.*—Of every method, that of the Koomas, besides being evidently the most painful, has the great disadvantage of correcting one deformity only by producing another. As a consequence, the forehead necessarily becomes the seat of an indelible cicatrix, which is sometimes very large. In those persons whose eyebrows meet over the median line, or who have the hair of the head very low down, the base and another point of the flap may remain covered with hair after the cure, without the possibility of prevention. Few men would consent, at this day, to sell their noses to a rich man, who would wish to obtain one in the place left by his own. Should that

which has been said of this species of animal grafting be true, the Parian method could only be put in practice in cases analogous to that spoken of by Garengeot. The Mogul method, the strangest of all, is subject to the same remark. The distress which would result from the necessary union of the two individuals until the base of the borrowed flap could be divided, will doubtless prevent the adoption of this method. As to M. Dieffenbach's ideas, it would, I think, be as injurious to adopt them exclusively as to reject them entirely. Although applicable to cases of mere deformity, or where the loss of substance is small, it will not suffice when there is an almost complete absence of the organ. A patient on whom MM. Lisfranc and Serre performed it, and whom I have seen at *La Pitie*, obtained very little benefit from it. And M. Marjolin told me that he had seen a man operated on in this manner at Rouen, who had not been more fortunate. Every thing seems to go on well for some time, but as the cicatrix hardens the tissues contract, and the new nose becomes more and more flat. It is, then, Tagliacozzi's method, or rather M. Graefe's modification of it, which seems most rational. It is there that we must seek the general method, whilst the others may be reserved for particular cases. The method of the Koomas, however, is the one which in our day has been the most frequently and completely successful.

When the bone has not disappeared, but only the lobe and the cartilages have been destroyed, the rhinoplastic operation may remedy in a great measure the deformity. In other cases there is much reason to fear that the new organ will reduce itself ultimately to a sort of stump, and remain always flabby, sinking in like a piece of linen from the pressure of the atmosphere. When the integuments of the forehead are used in the formation of the nose, it is necessary to leave the twisted pedicle large enough to preserve the circulation of the part. Before separating it from the root of the nose, and excising that portion above the neighboring surfaces, the operator should wait until the new tissues in front are firmly united. Instead of a roll of linen, a ball of charpie, or a gum-elastic canula, to maintain the opening of the nares, I prefer a plate of lead curved into a ring, which may, at the same time, also form a mould or pattern for the formation of the nose. M. Delpech seems to me to have very well combined every step of the operation. Although not absolutely necessary, the modification of M. Lisfranc, or that of M. Blandin, which is but an improvement of the other, has its advantages. In taking the teguments from the arm I do not know whether it will be more advantageous to follow the precepts of the surgeons of Sicily, or to imitate the professor of Berlin. Finally, this operation is one too little used to prevent each one from pursuing his own method; and the circumstances, too, that require it, are too different not to demand that the manuel of each operation should be left to the particular ingenuity of the operator.

Art. 2.—Other Operations on the Nose.

1st. *Excision of Tumors.*—The removal of tumors from the nose does not differ much from the same species of operation on other parts. I will, however, remark that the lobe of this organ being much thinner than one would imagine at first sight, it is very easily cut through, and that its perfora-

tion is almost necessarily followed by a fistula difficult to cure, on account of the atmospheric air passing through it.

2d. *New Operation.*—In describing the partition of the nose, Bichat indicated the possibility of an operation which, until very lately, remained a piece of theory, but which M. Rigal has just reduced to practice. Whilst resting against each other at the median line, the cartilages of the lobe leave between them a small groove perceptible even through the skin, which permits us to separate them, and to penetrate as far as the bony partition of the nostrils without opening these cavities. A cancerous tumor, developed under the anterior nasal spine, and which had gradually extended forwards and downwards, and sideways to the alæ of the nose, had yet scarcely altered its tegumentary covering. Two incisions united before, turning backwards and outwards, so as to resemble a Y reversed, having dug it out laterally, it became easy, by means of a transverse incision, to detach it below from the upper lip; then, by separating the two lips of the first incision, to reach the cartilage of the partition, its anterior edge was excised, and thus the whole morbid mass was removed. The sides of the division were then brought together, and the cure was not attended with any thing unpleasant, except that the cicatrization drew the tissues backward, and slightly flattened the alæ and apex of the nose.

3d. *Occlusion of the Nostrils.*—In consequence of confluent small-pox, syphilitic or other kinds of inflammation, the rhinoplastic operation itself, and, in fine, of all lesions which may alter the form of the nose, the anterior opening of this organ is liable to be closed, or at least contracted so far as very much to impede respiration. For all inconveniences of this kind there are three orders of remedies: 1st, dilatation; 2d, incision; 3d, excision. It is rare that simple dilatation will suffice; it is, besides, only adapted to cases of stricture or contraction, and not to those of complete closure. Incision, in its turn, almost always requires the assistance of dilatation. Excision becomes useful if tubercles or morbid projections require removal. If the opening be simply contracted, it should be cut in many eccentric rays, and more or less deep according to the degree of the disease. When it is entirely closed, a straight bistoury must be plunged into the place which the opening naturally occupies. By this means the operator makes an antero-posterior opening, the sides of which, I think, it will be well to incise at two or three points. As it is necessary at every hazard that these sides should heal separately, and in the position first given them, it seems to me that we shall better attain this end with a plate of lead rolled into a ring, or of such other form as may be appropriate, than with the dilating bodies commonly employed. This is, however, a very simple operation, on which I shall not dwell.

Rhinoraphia, or the simple suture of a cleft of the wings, or any other part of the nose, once successfully performed by M. Roux, being but a step of the rhinoplastic operation, or governed by the same rules as cheiloraphy, need not be discussed in this place.

SECTION II.

The Apparatus of Vision.

Art. 1.—*Lachrymal Passages.*

§ 1. *Anatomical Remarks.*

The nasal duct, formed internally by the posterior border of the ascending apophysis, the anterior third of the os unguis, and, quite low down, by a little lamina of the inferior spongy bone; without, forward, and behind, by the maxillary bone and its *cornet;* then a little by the hook of the os unguis; is from three to five lines long; cylindrical towards its middle; a little longer antero-posteriorly than transversely in its superior part; terminating below in a funnel-shaped orifice, and has but little solidity, except in the internal and anterior third of its circumference: whence it follows, that in attempting to pass through it it is extremely easy to break its other wall, and penetrate either into the nasal fossa or into the maxillary sinus. The lachrymal groove seems, in prolonging the internal wall towards the corresponding orbitary apophysis of the frontal bone, to become more and more superficial as it goes upward in the orbit, but presents, on the contrary, in the lower part of its extent, two lips easy to be distinguished: one, anterior, belonging to the ascending apophysis; the other, posterior, formed by the external crest of the os unguis.

The fibro-mucous membrane which lines the nasal canal, and to which it adheres but very feebly, becomes much stronger and more complicated in the groove, where it takes the name of the *lachrymal sac.* Here the straight tendon of the orbicularis muscle crosses its anterior face at a right angle, so as to divide it into two equal parts; one, superior, over which this tendon sends a fibrous expansion, known under the name of the reflected tendon of the naso-palpebral muscle; the other, inferior, covered outwardly by cellular tissue, the limits of which it is very important to know. The triangular space, limited above by the straight tendon, below by the rim of the orbit, and outwardly by a vertical line which touches the external edge of the caruncula lachrymalis, always comprehends this last portion. It is only covered by some fleshy fibres, a little laminated tissue, and the integuments of the greater angle of the eye. As it is badly supported by the surrounding tis ues, it yields easily to the action of the causes which tend to dilate it, and thus becomes the ordinary seat of the lachrymal tumor and fistula.

Surrounded by a small circle, dense and elastic, but not cartilaginous, the lachrymal puncture has a direction completely vertical, and forms a very evident angle at its continuation into the lachrymal duct, properly so called. The latter, which traverses only the anterior fifth of the free edge of the eye-lids, occupies more particularly its posterior part. Consisting only of the mucous membrane, it is very thin and superficial in its postero-superior half; whilst the rest of its circumference, consolidated with the lid, presents anteriorly and below a texture much more solid. It is this anatomical disposition which requires us to give the instrument, first, a perpendicular direction, then to incline much

more towards the nose than towards the eye, when we desire to pass it through the duct itself. At their entrance into the sac these ducts are sometimes separated by a small projection, a kind of spur; very often, however, they are confounded in the same opening.

Taken all together, the lachrymal sac and the nasal canal present a double curve, somewhat resembling that of an italic *f*; that is, that the first is slightly convex backwards and inwards, and the second convex in a contrary direction; so that to cauterize it from the upper eye-lid, it is necessary to take care, whilst the stylet traverses the sac, to incline its inferior extremity rather forwards and outwards than in a contrary direction, and that to pass through the nasal canal, it is better, on the contrary, to push the instrument backwards and inwards.

Thus, as every one may have observed, the axis of the nasal canal, in its relation to the superior orbitary projection, presents numerous variations. The depth at which it should be sought in the orbit presents as many more. In those subjects on whom the root of the nose is flat and broad, it seems to be thrown outwards and sensibly shortened; when the ossa-malarum are very near each other at their internal face, it can, on the contrary, be only reached by going much nearer the median line; when the forehead is very prominent, and the maxillary bone very much dilated, the lachrymal duct is at some distance from the posterior face of the orbicularis tendon, whilst it seems to pass a little in front of this tendon in those who have the canine fossa very deep and the forehead depressed. To discover it through the soft parts, the operator may, like M. Lisfranc, follow the inferior edge of the orbit, beginning from the cheek bone, and feeling with the pulp of the index finger until he feels, near the root of the nose, the anterior groove of the lachrymal sac, or by carrying the nail of the finger over the inferior and internal edge of the triangular space described above, after having by gentle pressure dissipated the engorgement of the soft parts. The sort of valve or diaphragm which contracts the inferior extremity, is commonly open only in its posterior half. Its orifice is six or eight lines deep in the nose, at the summit of an excavation, limited anteriorly by the base of the ascending apophysis of the maxillary bone, and inwardly by the concave face of the inferior spongy bone. As this excavation is a little longer from the lachrymal valve before than behind, it happens that it is sometimes very difficult to pass through the lower part, if the surgeon be ignorant of this arrangement. Sandifort, Callisen, and others, speak of concretions, small calculi that entirely obliterate the nasal canal. M. Demours has met with abnormal bands. M. Taillefer described a membranous fold occupying the superior third, the free edge of which, hanging downwards, was produced in many small filaments, which fixed it to another point of the canal, so that a stylet carried from below upwards was evidently arrested by this anomaly. Further, some have seen the canal entirely closed. Morgagni relates a case of its being double; Jurine and Dupuytren have also met with this arangement.

§ 2. *Obstruction, Tumor.*

Stenon, Valsalva, Stahl, and a veterinary surgeon quoted by Morgagni, had already attempted to explore the route of the tears by means of probes very fine and more or less appropriate, when Anel fixed public attention on this

point in 1716. According to his partizans, this operation is indicated in tumor, fistula, simple obstruction, obliterations more less complete, stricture partial or general, ulcerations, and chronic inflammations of the canals, sac, or puncta, as well as of the duct. It may be used for the introduction of threads, tents of different kinds, injections of medicated or other fluids, and may be performed either from the lids or from the nose.

1. *Anel's Method.*—Anel had two methods of treating affections of the lachrymal passages. Sometimes he attempted to remove the obstructions by means of a very fine stylet, slightly enlarged at one of its extremities; at other times, by means of detersive or otherwise medicated injections.

Injections.—For injecting he invented a small syringe of silver or gold, holding three or four drachms of fluid, terminated by a very fine tube, to the point of which was adapted a copper pipe finer still. The patient is placed fronting the strong light of a window. With the left hand for the left, and the right for the right eye, the surgeon moderately depresses the lid, and brings forward its free edge. With the other hand he manages the syringe; places the point perpendicularly in *the punctum;* in this direction sinks it in about one line, then turns it horizontally; sinks the little tube of copper about three or four more lines; then with the thumb upon the ring at the posterior extremity, and holding the body of the instrument between the index and middle fingers, gently forces the medicated fluid into the lachrymal sac. The operator should prefer the lower punctum in this operation, because by the upper, it would be less convenient and less sure. The first time the patient finds it difficult to bear. It is followed in some cases by considerable irritation. It is only after being several times repeated that the patient becomes accustomed to it, and that it produces only slight pain.

Catheterism.—When injections will not succeed, or will succeed only partially, in passing into the nasal fossa, Anel advises recourse to the probe. The operator places himself behind the patient; turns the lid slightly outwards and upwards; takes hold of the probe like a pen; places the button perpendicularly over the orifice; then inclines the base outwards and upwards, as if with an intention of carrying it to the external orbitary apophysis; sinks it gently; with the other hand draws the nasal portion of the lid inwards, and towards the internal orbitary apophysis, as if to give it a vertical direction; then pushes on the instrument in this direction, taking care at the least obstacle to draw it back and change its course a little, either forwards, outwards, backwards, or inwards, until it pass into the corresponding nostril; after which it is withdrawn to give place to injections.

The introduction of this probe is a delicate operation, and very fatiguing to the patient. It requires, on the part of the surgeon, an exact knowledge of the anatomical arrangement of the parts concerned. The smallest fold, natural or morbid, of the mucous membrane, suffices to arrest the instrument, which, in consequence of its fineness and flexibility, is really incapable of overcoming the slightest resistance; yet it continues to be described and used, because some surgeons, as we shall see hereafter, have applied it to the cure of fistula lachrymalis.

2. *Laforest's Method.*—Seeing that injections and catheterism, after the manner of Anel, were sometimes very difficult to be practised, and at the same time believing in their utility, Laforest and Allouel, following Bianchi, and

the veterinary surgeon cited by Morgagni, and supported by a passage from La Faye, invented almost at the same time a method of penetrating the lachrymal passages through the nostrils. To accomplish this object, Laforest made some small solid probes curved in an arc of a circle, and hollow probes of the same form, conical, open at their points, and terminated below by a pavilion furnished with a small lateral ring, proper to fix the instrument to the side of the nose during the intervals of dressing. The sound, passed from below upwards into the nasal canal, was intended to remove the obstructions. After this was withdrawn, the hollow sound took its place, and served for the injection of suitable fluids by means of a small syringe.

Remarks.—Like Anel's, the method of Laforest has been but rarely used for the purpose intended by its author; but other surgeons have attempted to combine it with certain steps of the operation for fistula lachrymalis. M. Briot, of Besancon, for example, is in the habit of using it constantly, and, as M. Vesigne says, with the greatest advantage. These injections, either from above or below, are means worthy to be kept in use. It is evident, in fact, that by applying medicated fluids to the seat of the disease, we may often render a more serious operation unnecessary. But it may be asked, if we may not accomplish the object by still more simple means; if fluids carried into the nose by means of fumigation or inspiration, would not traverse the lachrymal passages in the same manner? Moulac and Louis are said to have used this application successfully. Recently Mr. Mackensie has formally recommended, as a result of his own observations, to reject all syringes, probes, and canulas. It is sufficient, in his opinion, to throw once or twice a day some drops of the medicated fluid into the ocular lake, that is, the greater palpebral angle, and the puncta will absorb it and direct it through into the nose.

§ 3. *Fistula.*

When the lachrymal tumor is ulcerated, or when it resists the employment of Anel's, Laforest's, Louis's, or Mackensie's plans, the general or local antiphlogistics, formally recommended by Guerin and recently brought into favor by Gama and Lisfranc, as well as anti-syphilitic, anti-scrophulous, and other similar treatment, it is admitted in practical surgery that the operation, properly so called, must be had recourse to. Yet it must not be forgotten that Maitre-Jean saw two fistulas of the most serious nature spontaneously cured; that M. Demours rarely uses a cutting instrument in treating it; that the ancients, with their farrago of escharotics, styptics, caustics, and inefficient pharmaceutical compositions, also cured some cases; and finally, that in our own days it has been seen to disappear in those who have only been treated with local bleeding and low regimen. This will be the more important as it will enable us to comprehend the fact, that by every plan proposed, the fistula lachrymalis has been cured. As it sometimes cures itself, it is not to be wondered at that compression, which was formerly praised by Avicenna, and for the accomplishment of which J. Fabricius, Hunter, and de la Vauguyon, have invented very ingenious bandages; that tents of charpie covered with ointment more or less active, and that leeches and emollient cataplasms have favored the cure in many cases. Lately (November 1831), a male adult was sent to me at *La Pitie*, by M. Grenier, to be operated upon for fistula

lachrymalis. It was easy to prove the existence of the disease, which was of some months standing. Whilst I was preparing a canula, the fistula closed, and has not since reappeared. If leeching or any other medication had been used, this cure would inevitably have been attributed to it, and it is probable that it is in such cases they have sometimes been successful. Messrs. Mortehan, Caucanas, &c., have reported similar facts. Be this as it may, science now possesses an almost infinite number of methods of operating, adapted to the almost certain cure of this affection. To reduce the examination of these various methods to order, I shall divide them into five varieties or kinds. In the first, threads, tents, or some other foreign body is made to pass through the natural opening; in the second, the lesion is to be caused to disappear by means of mechanical dilators, introduced through the accidental opening; in the third, a metallic canula is left in the nasal canal; in the fourth, the disease is treated by means of the cautery; and in the fifth an artificial passage is formed for the tears.

1st. *Dilatation of the Natural Passages.*

a. Mejean's Method.—Observing that the employment of injections, and the removal of obstructions in the lachrymal passages with the probe of Anel, only destroyed the disease for a while, Mejean conceived the idea of applying to the nasal canal the treatment by dilatation, for a long time in use for stricture of the urethra. By means of a very fine probe, with an eye to receive a thread at its superior extremity, this author explores the passage, like Anel; endeavors to engage the head of the probe in the hollow of a grooved director, inserted for this purpose through the lower meatus of the nostril, and draws it out with the thread which it carries; this forms a kind of seton, the two extremities of which he fastens to a pin, which he fixes in the cap or hair of the patient. After a day or two he attaches two bits of charpie rolled up in the form of a tent, and covered with cerate or medicated ointment, and to which another thread is attached at its lower extremity. This tent is thus drawn from below upwards through the nose, into the superior portion of the lachrymal sac. It is every day renewed, and enlarged by adding a small portion of charpie. To extract it, the dresser uses the thread suspended in the nares, and which between the dressings remains fixed over the cheek by means of a small patch of taffeta.

By this method the treatment may continue for two, three, four, or six months. The cure obtained is rarely permanent. Out of twenty patients treated in this way, there were not more than three or four, according to the authors of the period, in whom the disease did not reappear after some months. Besides which, Mejean's method presents two difficulties not always easily overcome. The probe often becomes embarrassed in the lachrymal sac, and it is not until after long and fatiguing attempts that it can be engaged in the nasal canal. Unless the surgeon has great experience, he will often find it very difficult to bring the groove of the sound and the eye of the probe together at the inferior horn, or to seize the latter so as to bring it out.

b. Pallucci's Method.—Pallucci thought that, by introducing a small hollow sound, very flexible, in the place of Mejean's probe, it would be possible to pass through this sound a cat-gut cord so fine that the patient could force it through

by blowing his nose; which was then to answer the same purpose, and be used in the same manner, as the thread in the preceding method. But it is evident that this modification complicates the operation of the French physician, instead of simplifying it, and that it would be much easier to get through the lachrymal passages with a probe than with a canula.

c. Process of Cabanis.—Cabanis, a physician of Geneva, has proposed a very ingenious instrument with which to take hold of the probe of Mejean at the inferior meatus; it is composed of two narrow blades, susceptible of gliding upon each other, pierced with a number of holes, passing through the upper plate, but only penetrating to a certain distance into the lower. This instrument is passed under the inferior maxillary cornet. By proper movements the probe is engaged in one of the holes of the united blades; then these are made to slide on each other, one forward, the other backward, that the holes may lose their parallelism, and the probe become pinched. Cabanis also recommends that, after the thread has been drawn out at the nose, its extremity should be attached to a small flexible sound, which could thus be carried with certainty into the inferior opening, and, after the manner of Laforest, into the nasal canal. M. Bermond, of Bordeaux, who reproduced this idea in 1825 and in 1827, has correctly remarked, that to avail one's self of it, it is sufficient to get the conducting thread of Mejean out by any contrivance. As the instrument of Cabanis is not indispensable, and as the introduction of a probe and thread by the punctum counterbalances the advantages that could be subsequently drawn from it by the introduction of a sound, after the manner of Laforest, surgeons have not adopted these modifications.

d. Guerin's Method.—Having observed that a thread left in the superior lachrymal ducts, excoriates, and sometimes tears the palpebral orifice, Guerin recommends that the tent of Mejean should be brought up to this point. M. Desgranges, who found it better to seek the extremity of the probe in the nose with a small blunt hook than with the grooved sound or the plate of Cabanis, adopted this idea, which Dr. Care has recently endeavored to diffuse.

e. Process of M. Care.—The process of this physician consists in passing from below upward, with Mejean's instruments, a tent of raw silk composed of three, four, or six strands, as many in fact as can be passed, and with them dilating the conduits and puncta. One of its extremities is afterwards fixed upon the forehead of the patient, when it has been passed from below upward, or on the side of the nose, if in a contrary direction. A small ball is formed of the other extremity, which may be fastened in the hair. M. Dubois appears to have followed this course several times, and I have seen it used once at the *Hopital de Perfectionnement*, by M. Bougon. Its partizans think that a tent of this size is not liable to tear the punctum, and that the dilatation of the lachrymal duct which it produces is one of the best means of curing the disease of the canal itself. We may condemn it, in my opinion, as only dilating the healthy parts, without acting directly upon the diseased point of the organ through which it passes, and also of deforming and paralysing the puncta and their ducts. Reason appears to me altogether against the method; and as I have not learnt that experience has pronounced in its favor, I think that it should not be preferred. I cannot even see any thing that should induce us to try it.

2. *Dilatation through an Accidental Opening.*

a. Process of J. L. Petit.—Petit was the first who fully showed that the operator should endeavor to establish a passage for the tears through the natural channel, rather than create a new one. His method may be considered as the mother of all those of the present day. The assistant, placed behind the patient, draws the temporal angle of the lids outwards to steady them and straighten the tendon. The operator then carries the point of a bistoury into the sac, below the tendon of the orbicularis muscle; makes an incision about six lines long at the greater angle of the eye; slips in the place of this instrument a grooved sound, which he pushes with more or less force into the nose, in order to destroy the obstacles that oppose the passage of the tears, and introduces by its aid a tent or conical bougie of wax, the extremity of which must be more or less swelled, and secured by a thread. The bougie should be changed, or, at least, cleaned every day, until the canal gives no further signs of suppuration; that is, for two, three, four, five, or six months. J. L. Petit afterwards thought that he could dispense with the grooved sound, by making a groove near the back or upon the anterior face of the bistoury, which would serve to direct a blunt probe; but as this rendered it necessary to have a particular bistoury for each side, operators have generally neglected this supposed improvement.

b. Process of Monro.—The reputation that Petit's method at first gained did not prevent some surgeons from combating it or exposing its defects. According to Monro, it would be imprudent to open the sac without supporting its external or anterior wall. It was for this purpose that he proposed to pass a small probe through the inferior lachrymal punctum to distend it, and to allow of its being opened without wounding the posterior wall. Monro also recommends that the canal be forced with an awl rather than a probe; that the opening of the sac be continued upwards with the scissors, at the risk of dividing the straight tendon; and that, instead of the bougie of Petit, the operator should use a tent of charpie or cat-gut. These precepts are now disregarded. The wounding of the sac behind, besides being easily avoided in the common method, is not dangerous, whilst that of the tendon of the orbicularis muscle is always so, and the employment of an awl may, by a slight misdirection, produce false passages.

c. Pouteau's Process.—Introduced from above downwards, the bougie ultimately produces in the great angle an ulcer, the edge of which turns inward, and consequently leaves a cicatrix strongly depressed. Having attempted Mejean's method in vain for a young woman, and not daring to propose an incision of the sac, after the manner of Petit, Pouteau resolved to carry his bistoury between the straight portion of the edge of the inferior lid and the caruncula lachrymalis, so as to penetrate into the nasal canal without touching the skin. There followed, says the author, only a slight ecchymosis, because he made the incision small. No person, however, has imitated him, from the fear of irritating the conjunctiva. Besides, the inconveniences for the remedy of which Pouteau recommends it, have been so much reduced in modern surgery, that no one now takes notice of it.

d. Process of Lecat.—After having incised the sac, like Petit, Lecat

uses tents of charpie, which he carries from above downwards through the nasal canal by means of a cat-gut or Mejean's probe. In this respect, he is the first who has endeavored to combine Mejean's method with Petit's; but as his tent must produce the curling down of the edges of the wound, which is so much the subject of apprehension, the profession has never paid great attention to his precepts.

e. Desault's Method.—To obviate as many as possible of the inconveniences of the preceding processes, Desault modified almost all of them, and combined several. By his method, the incision of the sac is made only of two or three lines in extent. A grooved sound is then used to overcome the obstruction in the canal. Then a cylindrical stylet or probe takes its place. A small silver canula, from ten to twelve lines long, conical, and furnished with a ring on the side of its pavilion, is carried from above downwards, into the nose by means of the stylet or probe, which represents a conductor, and which is then withdrawn. The thread is then passed down, and its extremity brought out by the patient's blowing his nose, after which the operation is not different from Mejean's.

f. M. Boyer's Modification.—To make as much of the thread descend through Desault's canula as may be required, we may imitate M. Boyer, and use a small probe three or four inches long, bifurcated below, and terminated with a ring above; and afterwards, to extract this thread from the nose, we may use the little hook of Guerin, or the dressing forceps, or trust to the patient's forcing it out by blowing his nose. If none of these will serve, it may be left in that organ, as the mucosities of the schneiderian membrane will almost always bring it out in the course of twelve or twenty-four hours. If, however, it should be otherwise, injections thrown with some force through the opening in the lachrymal sac never fail to bring it out.

g. Method of Pamard.—Opposed by the difficulties of extracting the ligature by Desault's method, Pamard, of Avignon, and Giraud, almost simultaneously made an improvement which surgeons of the present day still practice. It is a small elastic probe, made of a watch spring, with a button at one end and an eye at the other. The head of this spring is passed into the canula, and when it has arrived under the inferior horn, its elasticity naturally directs it either to the opening of the nares or under the lobule of the nose, where it may be reached with the fingers, or a pair of dressing forceps. M. Roux scarcely ever uses any other method, and it cannot be denied, that he most frequently completes the operation for fistula lachrymalis with great celerity; yet, when the spring is not well tempered, and even sometimes when it is most perfectly finished, its extremity is disengaged with much difficulty from the inferior meatus. Whence M. Boyer feels himself bound to adhere to the method of Desault, although he practices in the same establishment with M. Roux, and although he has frequently employed the spring needle of Pamard.

h. Process of Jurine.—In order to leave the least possible deformity in the angle of the eye, Jurine performed his operation with a small trocar of gold, the canula of which was pierced near the point. He passes it into the nose, and then, after withdrawing the stylet, passes by its canula the spring of Pamard. The rest is performed according to the rules above laid down. If, in spite of its apparent simplicity, this method has not been followed, it is

because, in reality, it is more painful and difficult than several others. It will always be more rational to open the lachrymal sac with a bistoury than with a trocar; after that, Pamard's method is preferable to that of Jurine.

i. M. Fournier's Method.—An extremely ingenious modification, and one which I am astonished not to have seen in our modern treatises, is that pointed out by M. Fournier, of Lempde. This physician recommends to attach a shot or a grain of lead to the ligature of Mejean. By its own weight, this will pass through the canula of Desault, and fall into the interior of the nose, from which the patient may make it pass without difficulty, by taking the simple precaution of leaning forwards.

10. The editors of Sabatier have, it appears to me, justly observed, that the combination of Mejean's and Petit's method may do away with all the instruments of Desault, Pamard, Boyer, and Roux. What need is there, in fact, of passing into the nasal canal successively, a probe, a stylet, a canula, and a watch spring? Why not be satisfied with putting the thread in the conductor, and passing the latter into the nose as soon as the sac is opened? The spring, crotchet, and canula of M. Benezech, proposed in 1807, for the more easy extraction of Mejean's stylet, have no superiority over most of the means already spoken of, and consequently need no further mention.

j. Process of M. Jourdan.—Fearing he should not otherwise expose the whole extent of the disease, and wishing to avoid a cicatrix of the integuments, M. Jourdan proposed to open the lachrymal sac behind the internal commissure of the eye-lids, on the inside of the caruncle. M. Vesigne is wrong, certainly, when he says that most frequently it will be impossible to follow this advice; but it is not the less true, that M. Jourdan's method offers no advantages over the others; that it incurs the risk of wounding the inner extremity of the lachrymal conduits, of dividing Horner's muscle, and will produce more pain and present more difficulties than any of those now in use.

k. Process of Scarpa.—While, in France, we were endeavoring to spread the method of Mejean, the surgeons of Germany, Italy, and England confined themselves to modifying that of J. L. Petit. After clearing the sac and canal by means of a tent covered with red precipitate, or of the nitrate of silver, Scarpa advises us to pass a probe or conical nail of lead, terminated by a flat head, more or less inclined upon the shaft, so as to accommodate itself to the inner angle of the eye. This nail was to be withdrawn from time to time, washed, and returned. During the first few weeks the surgeon was to take care of this himself, and inject warm water into the lachrymal appendage before replacing the probe, which Scarpa called *the conductor of the tears.* Afterwards the patient needed no assistance in performing this dressing. When the tears begin to find their way without obstacle, into the nose, and when the nail ceases to exhibit purulent matter on being withdrawn, it may be laid aside; yet it is best to continue it some weeks longer, for greater security against a relapse. To some patients, says Scarpa, it produces so little uneasiness, that they would be willing to continue its use all their lives, and who have no repugnance to wearing it for eight or ten months, or a whole year. I have seen M. Dubois and M. Bougon, in Paris, use a cone of lead with success, which differed from that of Scarpa only in having its superior extremity bent into a crotchet, instead of being flat, like the head of a nail.

l. Process of Ware.—There are some who prefer a silver style to the leaden tent which I have just mentioned. Dr. Ware, for example, introduced among the English surgeons a silver nail or style, almost exactly similar to the leaden one of Scarpa, and which M. Larrey has, in his turn, replaced by one of cat-gut.

Permanent Canula.

According to Louis, Foubert conceived the idea of retaining a silver canula in the nasal canal. It was about an inch long, conical, and terminated in something like the bowl of a spoon above. Bell and Richter had also spoken of this canula, but Louis having formally denounced it, it was hardly thought worthy of trial among surgeons of that time, notwithstanding the efforts of Pellier, who, in 1783, announced himself as its inventor, and gave arguments in his work which plead strongly in its favor. Pellier had also modified it very ingeniously. His canula was shorter than that of Foubert, and terminated in a smooth fillet above and a pen-point below, and had another fillet round the middle, so that, once in place, it was impossible for it to go up or down. It appears never to have fallen into complete disuse. M. Distel published, that one of his patients wore one for more than fifteen years, and that another of tin had been in use more than forty years. I see, too, in a thesis published in 1803, that at the hospital of Strasburg no other method is followed. M. Marschal has given us new and conclusive observations upon it. In Germany it was also employed by Himly and Reisinger. But in the schools of Paris it had been entirely forgotten, when Dupuytren recalled it to the recollection of our operators. He gave it but one fillet instead of two. This fillet is concave within, where it presents a circular groove, and is so made that, to withdraw the canula, if any accident should require it, it is sufficient to introduce into its interior the point of an elastic forceps, terminated with two little crooks, with the points turned outwards, to draw it upwards. That of M. Brachet, of Lyons, presents a second swelling at its inferior extremity. M. Taddei, who speaks highly of it in a memoir published in Italy, approaches much nearer than any others to the views of Pellier, in advising a slight enlargement below its superior third. M. Grenier, who thinks that the canula escapes only because it ceases to be sufficiently pressed by the canal, has proposed one that will contract when compressed, and enlarge again, like a spring, when left to itself.

To place it, it is necessary to have a stylet of steel, silver, or gold—which is a sort of lever bent almost at a right angle—the inferior limb of which is to be fitted to the calibre of the canula, and limited by a shoulder. The handle of the instrument (the other limb) is more or less flat, and two or three inches long. The lachrymal sac is to be opened as in the other methods. The stylet, furnished with a canula of suitable dimensions, is then carried upon the back or anterior face of the bistoury, so as to penetrate the nasal canal as that instrument is withdrawn. When the enlargement of the canula has been passed within the lips of the incision, it is to be fixed at this point by the nail of the first finger, whilst the style is withdrawn. The patient is then required to force out his breath, and if any of it pass by the angle of the eye, the operation is well done. M. Taddei thought that, before introducing the canula, it

would be proper to remove the obstructions in the canal by a probe, or cylindrical stylet, and M. Cloquet does not introduce it until after using tents for some days. It is said that M. Lisfranc makes a larger incision in the integuments than M. Dupuytren recommends. But the stylet performs exactly the office of a probe, doing thereby at once what M. Taddei effects by two different operations; and it is evidently useless to divide the parts to a greater extent than is absolutely necessary for the passage of the canula. To penetrate through the inner face of the lid, as recommended by M. Vesigne, to prevent a cicatrix, is certainly superfluous, and this is assuredly not a case for conforming to the precept of Pouteau. For the purpose of rendering the operation still more simple and speedy, Daviel invented a sort of trocar or stylet, ending like a lancet point. This, by carrying the canula with it into the canal, reduced the operation to a single process. This ingenious modification, although applicable to the more simple cases, would be often inconvenient, on account of the small opening it makes in the skin.

The canula should be of silver, gold, or platina, and of such strength as not to be easily altered in its form. Its size and length should vary to suit the subject. It is necessary it should exactly fit the calibre of the nasal canal, and pass a little beyond its inferior extremity. Consequently, in an adult, it should be from five to eight lines long, and from one to two lines thick. It should also be slightly curved backwards and inwards, and its point, cut into the form of the nib of a pen, should prolong the anterior and external, rather than the nasal side of the canal. To adapt it to the size of different individuals and to their different ages, M. Grenier has found a means which, it appears to me, exactly answers the purpose. It is, that the length of the canal is represented by a line drawn from the point of incision in the angle of the eye to the superior depression in the ala nasi, at the junction of the inferior edge of the os malæ with the ascending apophysis of the maxillary bone.

Many objections have been made to this method. Here is a foreign body, it has been said, which must necessarily fatigue the part, produce cephalalgia, more or less uneasiness in the nose and face, erysipelatous affections, phlegmon abscess, or ulceration of the angle of the eye. It often rises up under the integuments, and requires to be withdrawn. M. Darcet has stated twenty-seven cases where its extraction became indispensable. M. Delpech has seen it pass through the arch of the palate. Mucosities and the snuffs which many persons use, may obstruct or close the orifice, and thereby renew the disease, as has been shown by M. Maunoir. Finally, when it requires extraction, we must have recourse to an operation more important than for the fistula lachrymalis itself.

All these objections have some foundation. But, on the one hand, it is in most cases the operator, and not the operation, that should be blamed for any ill consequences that may occur; and, on the other hand, there is no method without risks of this kind. No doubt, if the canula slip in between the soft parts and the maxillary bone, as I have twice seen, instead of remaining in the canal it will give rise to more or less important symptoms, without being of any benefit, properly speaking, to the fistula; that this will also be the case, if it be pushed into the maxillary sinus, or into the parieties of the canal; if it descend between the bone and the membrane of the canal; in a word, if it be not exactly in the natural route of the tears. It is also clear that a large canula

cannot be passed without danger through a canal too small, and yet, that if the former be too small, the operation will be equally unsuccessful. But it is the duty of the surgeon to know how to avoid these mistakes, or at least, when he makes them, not to charge their effects upon the method of operating. In all other modes of operating, it is necessary to renew the dressings each day for several months. There is none of them but what has been attended by cephalalgia, erysipelas, &c. By Dupuytren's method, a few seconds only are necessary to complete the operation. The disease is almost immediately cured. No dressing nor particular care is indispensable. Most patients return immediately to their habitual occupations. By this process we can secure success in twelve out of twenty operations. A young woman, whose lachrymal duct was so small that I was compelled to use considerable force in introducing a canula of a very small diameter, had a slight cephalalgia for three days. In another case, that of a young man aged twenty-one, I had, as it were, to force the duct in order to pass the canula. I kept him at *La Pitie;* the next day he was well, and no accident followed. The worst that can happen, after all, is that we may be obliged to withdraw the instrument; but this is not so very serious or important; it is done simply by finding again the superior opening of the canal, and withdrawing the offending body. When any difficulties are met with, the double crotchet and canula of Dupuytren, the little hook of Cloquet, or the two-headed mandrin of M. Caignou, will at once obviate them. We might also use a pair of small dissecting forceps, one of the points a little turned inwards. With any one of these instruments, by placing the hook in the circular groove of the expansion, or beyond the extremity of the canula within, we can draw it out quite easily, by making it follow the same route by which it was introduced. I have withdrawn it four times, and found the dissecting forceps always sufficient. It should be observed besides, that after the extraction of the canula, the patient is in just the same state as those who have been treated the same length of time by the dilating method of Petit, and that many find themselves even then radically cured, as I have twice seen. I would not say that the canula is suited to all cases. When the canal has been thrown out of its natural direction by exostosis; when it is much closed by some hard substance or by ulcers; or when it is the seat of more profound lesions still, it will be better to have recourse to Mejean's seton, or some other more appropriate method. I would only say that it is practicable whenever the method of Petit, modified by Ware, Scarpa, or Dubois, can be applied, or any mode of treatment depending upon mechanical dilatation, and that it is far preferable to them all.

4. *Cautery.*

Fistula lachrymalis was treated by injections and tents introduced into the nasal canal; by escharotics, and even the actual cautery, before the course of the tears was perfectly known. These various methods are clearly indicated in the works of the Greek and Arabian physicians, and the authors of the middle ages; but it was under the same title with all other fistulous ulcerations. Their ignorance of the anatomy of the lachrymal apparatus did not permit them to look upon it in any other point of view. For more than a century cautery had scarcely been thought of, when, in 1832, M. Harveng, of Manheim, proposed to found upon it a new method of treatment. It

was soon seen that this duct resembled the urethra, and that its coarctations might be submitted to the same general treatment. At present there are two methods of applying the cautery: one by penetrating from above downwards, the other by introducing it through the nasal fossa.

a. Superior Operation.—1. *Process of M. Harveng.*—After opening the lachrymal sac, M. Harveng advises to pass a cautery at a white heat, or a tent covered with nitrate of silver, through a canula to the obstructing points; to reapply it once, or oftener if necessary, and to proceed generally, as recommended by Ducamp, in treating affections of the urethra. According to M. Vail, who published a thesis upon it in 1824, Mortier, of Lyons, had a long time before suggested the same idea, which was also attributed to M. Janson, and that M. Taillefer, who has also been thought to be its author, again brought it forward, in 1827.

2. *Process of M. Deslande.*—In the month of May, 1825, M. Deslande made known another mode of accomplishing the same purpose. An ordinary mandrin is at first introduced into the nasal passage, to remove obstructions and open the way for the port-caustique; there is then slipt into its place another instrument of the same form, with two longitudinal grooves in its vertical limb, filled with fused nitrate of silver. The instrument is turned upon its axis, so that the whole canal may be cauterized, and the operation is finished.

b. Inferior Operation.—I learn from M. Blanc that, in 1824, M. Gensoul dispensed with opening the great angle of the eye, and passed the nitrate of silver by the inferior meatus of the nasal fossæ. M. Bermond, of Bordeaux, in 1825, inserted a memoir into the journals on the same subject. M. Valet said something of it in a thesis, in 1826. And M. Ratien, who was no doubt ignorant of these various attempts, announced, in 1828, that he hoped to be able to apply Ducamp's method to the treatment of fistula lachrymalis, by penetrating through the inferior orifice of the nasal canal. These surgeons first propose to determine the place, the form, and the extent of the disease, and then to pass the caustic with certainty and facility. In penetrating by the angle of the eye, as recommended by Mortier, Harveng, and Taillefer, the operation presents no difficulty; but by the other method, we must begin by making ourselves familiar with the method of Laforest.

1. *Process of M. Bermond.*—After having introduced from without the conducting thread of Mejean, M. Bermond attaches it to the ring of a tent covered with wax, which he then draws into the nasal canal to take an impression of its form. By means of a thread attached to the free extremity of this little bougie, he withdraws it by the nose, and puts in its place a tent made of charpie, covered with a thick paste, which is rendered caustic in the parts corresponding to the obstructions. This method, which is certainly the most ingenious, has but one objection: it requires the previous introduction of a thread through the punctum lachrymale, the canal, and the sac.

2. *Process of M. Gensoul.*—A small catheter, curved so as exactly to suit the passage it has to traverse, is at first passed under the inferior corner and into the nasal canal, to discover the seat of the disease; which is then immediately attacked with nitrate of silver, by means of a port-caustique. More than three hundred cases have been treated in this way by M. Gensoul, some with complete, others with partial success, and many without any advantage

at all. In order to give his mandrin and canula a suitable form, he obtains an exact cast by means of the fusible alloy of Darcet. Some instruments made in this way were shown me, in 1826, by M. Blanc, and I was truly astonished at the facility with which they could be passed into the lachrymal conduits.

Remarks.—In proposing to cauterize the nasal canal, the surgeons I have named have pretended to nothing more than to apply Ducamp's method to the lachrymal passages. If cauterization be proper for the obstructions of the urethra, it must be equally applicable to those of the nasal canal, it is true; but it appears to me, that in neither has the action of the remedy, nor the affection which we seek to destroy, been accurately known. As in those of the urethra, the contractions of the nasal canal are produced, and commonly continued, by a more or less extensive, more or less exactly circumscribed, chronic phlegmasia. The spasmodic stricture spoken of by Janise, and to which Richter attributes so much, is never the cause of fistula lachrymalis. The affection of the lids, called in by Scarpa, only becomes a cause by spreading itself to the lachrymal sac and as far as the nose, where, by the engorgement and swelling it induces in the mucous membrane, it creates an obstruction of the course of the tears. In other words, the fistula and lachrymal tumor depend upon an induration, thickening, or simple chronic phlegmasia of some point in the lachrymal passage. Now, in applying the nitrate of silver to an organ thus altered, we do not cure it by producing merely an eschar or a burn, but by dissipating the inflammation, by neutralizing or destroying the stimulus, and producing thereby a resolution of the morbid engorgement.

It follows from this, that the nitrate of silver is the only caustic that can be reasonably employed, and that those casts or impressions of the canal with which physicians have been so much occupied, are nearly useless. The principal object is to make the caustic reach the superior part of the canal, if it be introduced from below, and the bottom, if introduced at the other extremity, so as to act upon nearly the whole extent of the passage. Whatever precautions the surgeon may take to prevent this general action, will not avail. As soon as the nitrate comes in contact with the living and moist membrane, it melts and spreads itself in such a manner, that it is enough to touch one point of the canal to make the whole feel its effect. And much the same may be said of dilatation. When a tent or bougie, or the like is placed temporarily or permanently in the nasal canal, it appears to me that it can only be useful in one of two ways: by serving as a vehicle for medicinal agents proper to dissipate the disease, or else by the compression of the affected canal, which is cured in the latter case, not by mere dilatation, but by a true resolutive pressure, the same as that which cures œdema, some kinds of dartre erysipelas, &c.

5. *Formation of a New Canal.*

We see in Aetius and Paulus Ægineta, that Archigenes pierced the os unguis with a drill, to give the tears a passage into the nose. Rhazes and Avicenna cite Sabor-Ebn-Saiel, as an eulogist of this method, but which is condemned by Mesue and Guy de Chauliac. Every thing favors the belief that Celsus, Abul-Kasem, and Roger, of Parma, accomplished the same pur-

pose by the application of the actual cautery to the os unguis. But at least G. de Salicet advises us, when the bone is diseased, always to cauterize it sufficiently to allow the tears to pass into the nose; which was also the method of J. de Vigo. This operation was almost entirely forgotten for several centuries, and owes its reintroduction into practice to Woolhouse. It was almost the only manner of treating fistula up to the time of Petit and Mejean.

1. *Process of Woolhouse.*—The operator makes a semilunar incision at the greater angle of the eye, which comprehends the tendon of the orbicularis palpebrarum; opens freely the lachrymal sac; denudes the os unguis, and then fills the wound immediately with lint; postponing the remainder of the operation for twenty-four hours, or even two or three days, in order to be free from the embarrassment produced by the blood. Then a pointed wire is thrust downwards, inwards, and a little backwards, through the inferior part, or the larchrymal groove of the os unguis, into the nasal fossa. A tent, or a small conical canula is afterwards introduced into the opening, to prevent its closing. Then, when the edges have cicatrized and become callous, a canula of gold, slightly contracted in the middle to prevent removal, is introduced and permanently retained.

2. *Process of Saint Yves.*—Saint Yves, who had noticed, as all other operators had, that Woolhouse's method was almost always followed by inflammation, or by an eversion of the eyelids, perceived that this inconvenience could be avoided by avoiding the tendon of the orbicularis muscle in the incision at the angle of the eye. He also preferred perforating the os unguis with the actual cautery, so as to occasion an actual loss of substance.

3. *Dionis' Process.*—Lacharriere, Dionis, and Wiseman, also recommend the cautery, which they passed through the lachrymal sac, protected by a funnel-shaped canula.

4. *Process of Monro.*—Schobinger, Monro, and Boudou, used a trocar to perforate the bone, fearing less than Woolhouse to wound the ethmoides. Ravaton thought to accomplish the same purpose by means of a quill, a curved forceps, with which he broke away the os unguis to a considerable extent, and a leaden canula; but none of these methods will be followed by a perfect cure. Although the artificial opening may be maintained by a tent or canula for some time, it almost always closes up at last; and it is rare that the canula of Woolhouse can be retained long enough to render the new passage permanent.

5. *Hunter's Method.*—Hunter thought he should succeed better by taking away at the same time a disc of the os unguis and of the two membranes that covered it, so as to form a circular opening two lines in diameter, attended with a complete loss of substance. To accomplish this, he invented two instruments; one, a kind of canula with a cutting extremity, like a harness-maker's punch; the other, a flat piece of horn or ebony, curved so as to be passed into the nasal fossa to serve as a support on which the punch was to act. With these a very neat opening could be made in the greater angle of the eye, which it would be enough to dress with a plug of lint to cause it to cicatrize and become rounded and callous. As it is almost impossible to apply the nasal plate, and as the perforation with the actual cautery is also accompanied with loss of substance, without being followed with success, no per-

son has yet attempted the operation of Hunter upon the living subject, and he appears never to have tried it himself, except upon the dead subject. But if any one should wish to try it again, he can very easily do it with the punching compasses of M. Talrich, or those of Sir Henry. The pierced branch, introduced into the nose, serves as a point of support to the perforating branch, which is applied to the greater angle directly through the wound in the canal. Then, by pressing them together, a portion is removed without any risk of injury.

6. *Scarpa's Process.*—Scarpa and M. Bouchet have lately returned to the use of the actual cautery, according to the views of Saint Yves. That is, after opening the greater angle, as in the operation for simple fistula, without touching the tendon, they fill the wounds with charpie, and leave it so for twenty-four hours or more. Then, with a metallic wire heated to whiteness, they penetrate from the inferior and internal part of the lachrymal sac into the nose. To secure the eye and neighboring soft parts from the action of the cautery, Scarpa used not the simple funnel of Verduc or Dionis, but a conical canula, with the sides very thick, and furnished with a handle several inches long, connected with the base at a right angle, invented by Manoury and used by Desault, and of which the first ideas are found in Roger, of Parma. Rivard and A. Petit open the sac behind the lid, like Pouteau, whether desiring to penetrate into the nose or to stop at the canal.

7. *Process of M. Nicod.*—More recently, M. Nicod has proposed to combine perforation with the trocar and the actual cautery.

8. *Process of M. Pecot.*—Supposing that he had observed that M. Briot, by mistake, once introduced the canula through the os unguis, and once in the antrum highmorianum, without any bad consequences, M. Pecot, of Besancon, thought it would be well to fix the canula in the maxillary sinus through the external and posterior wall of the canal, instead of searching with painful obstinacy for the canal itself. This is better than nothing, doubtless, if nothing else could be done; but I doubt, notwithstanding the reasons recently adduced in its favor by M. Laugier, whether such a method will ever obtain many advocates. There is no proof that when the tears have reached the sinus they can escape easily from thence, and that they may not produce serious symptoms there. The perforation of the os unguis has fewer inconveniences.

Remarks.—Woolhouse's method, rejected by Marchetti, Solingen, Maitre-Jean, and especially by Nannoni, will be but rarely adopted at the present time. Wherever it is possible to operate upon the natural passage, it would be wrong to attempt the formation of a new one. Where it is not, it is more rational to imitate M. Dupuytren in making a new passage in the direction of the natural one, than to perforate the os unguis or the sinus, like Saint Yves or M. Pecot. When there is necrosis, the fistula should be treated by one of the other methods; for the disease of the bone requires no other care than if it had had its seat in any other part of the body. The employment of the actual cautery, or of chemical escharotics, is always dangerous so near the eye. They have more than once produced obliteration of the lachrymal conduits, and consequently incurable epiphora. The value of Woolhouse's method is still further lessened, by the fact that the tears rarely acquire the habit of falling into the nose even when the route which has been opened for them

continues open; so that, besides the deformity at the greater angle of the eye, the patient remains affected with a weeping most frequently beyond the reach of art.

Whatever method may be preferred, there is one step nearly the same in all; I mean the opening of the sac and the exploration of the canal.

In order to have every possible assurance of reaching the canal, the operator is to be aided by an assistant, who draws the eyelids towards the temple; with the index finger corresponding to the diseased side he seeks in the greater angle for the anterior lip of the lachrymal trough, and disperses by gentle pressure any gummy matters that may lie there. Then, seizing a straight, firm, and narrow bistoury with the other hand, he passes the point of it behind the nail of the directing finger, and sinks it obliquely inwards, backwards, and downwards, into the sac. Then, raising the handle of the instrument towards the eyebrows in order to descend perpendicularly into the nasal canal, he calls for a drill armed with a canula, if he intends to follow Foubert's method, or a grooved sound or stylet, if he wishes to imitate Petit or Desault, and carries its extremity upon the back or the anterior face of the bistoury in such a manner that, while the latter is being withdrawn, it serves as a director for the former. When the opening of the fistula is sufficiently large to permit the passage of the canula or the sound, the bistoury may be dispensed with. In other cases the ulcer may be left above, below, or at the side of the incision, acting, in fact, as if it did not exist; if it be surrounded with troublesome fungi, they are first removed.

When he does not follow the process of M. Bermond for cauterizing the canal upwards, the operator, holding the catheter or probe as a pen, introduces it, with the concavity turned downwards and outwards, to the depth of about an inch; then, raising the outer end a little, that the other may become engaged under the inferior spongy bone and glide upon the nasal wall, withdraws it gently to within six or eight lines of the opening of the nose; turns its concavity by degrees outwards and upwards; then, by a cautious swaying movement, endeavors to introduce the beak of the instrument into the orifice of the nasal canal, whence the instrument may be passed without difficulty to the angle of the eye, or into the lachrymal sac. Force here is never necessary. Resistance can only arise from a bad direction of the instrument, or some anatomical variation. By inclining the sound too much upwards or downwards, inwards or outwards, its summit may be carried against the opposite wall, or the circumference of the inferior orifice of the canal. The curvature of the sounds of Laforest is bad, making the operation difficult and hazardous. These instruments should not form the arc of a circle, but be bent at almost a right angle, and be very blunt. With this form, the passage of the canal is really very simple, and I think, with Versigne and Gensoul, that modern operators are wrong so entirely to neglect it.

The lachrymal conduits and puncta may be obliterated by a variety of diseases, such as erysipelas, small-pox, &c., producing a continual weeping, as stated by Anel, J. L. Petit, &c. Yet Gunz says that he saw a case of this kind, where the tears had found a passage into the canal by means of porosities visible to the naked eye.

Mejean's stylet, passed from the sac towards the lids when the obstacle is near the orifice, or towards the nose when it has its seat lower down, will, in

some cases re-establish the passage for the tears; otherwise the disease is almost incurable. It will be useless to attempt the formation of a new duct with a needle, drawing after it a thread or seton. The tears will not pass by it. It cannot be kept open, nor made to suck or absorb the lachrymal secretion like the natural one. Nor is there better reason to believe that epiphora would be prevented by making, like A. Petit, an opening into the sac behind the internal angle of the eyelids, because the artificial orifice never acquires the organization of the punctum lachrymale. Nevertheless, it is almost the only resource left us in such a case.

If an ulcer, or other lesion, perforate the lachrymal conduit towards the eye, there results a fistula of a peculiar kind very difficult of cure. A thread of gold or silk, or better, of small cat-gut, passed like a seton through the wounded conduit from the punctum to the sac, is the only remedy we have for such an infirmity, unless we lay open the canal from the inside of the lid.

Instead of opening at the greater angle of the eye, the lachrymal tumor sometimes makes its way into the nose through the os unguis, of which Heister gives an example. In internal fistulas, it is not the re-establishment of the natural course for the tears that requires our assistance, but the cure of the ulcer. If there be a tumor, even if the conduits or puncta are closed, we have no other treatment to apply than that which is necessary for an abscess, or for chronic inflammation. First, compression, resolvents, or astringents; then an opening of the cyst with the bistoury, and the subsequent employment of a tent or detersive injections, are all that is necessary, unless we place a permanent canula in the canal.

However much the sac may be distended, it is rare that we shall have occasion to follow Mr. Boyer's precept, to excise a portion with the scissors, or that of M. Guerin, to resort to compression. Cauterization with the nitrate of silver, as recommended by Scarpa, is evidently preferable.

Art. 2.—The Eyelids.

§ 1. *Ectropion.*

Eversion of the lids may be produced by two causes: swelling of the conjunctiva and contraction of the skin. The latter, properly called *ectropion*, is the most serious. The former, which is more easy to cure, and more rarely seen, shows itself in an acute or a chronic form. It forms what is called lagophthalmia. When recent, cauterization with a proper instrument, as directed by G. de Salicet, ordinarily produces a cure. M. J. Cloquet cured it in this way, when of more than a year's standing. Saint Yves and Scarpa praised the nitrate of silver in such cases; and a great many dry collyria have been used with like success. Calomel and sugar, tutty, white oxide of bismuth, finely pulverized, with an equal part of sugar-candy, have obtained me surprising and prompt success, applied by pinches night and morning upon the engorged part.

When these have been tried in vain, we may imitate Acrel, in passing a thread through the lid near its ciliary border, with which to draw the lid into its natural position; or instead of the thread, we may use strips of adhe-

sive plaster, as recommended by J. Frabricius and Solingen, the free extremity of which is to be fixed upon the forehead for the lower lid, and on the cheek for the upper. But it is much more simple, sure, and prompt to excise the fungous conjunctiva at once. It is the method adopted by all the moderns, and prescribed by Antylus, and even recommended by Hippocrates, although confusedly, where scarification has been unsuccessful. While the lid is held everted by an assistant, the surgeon seizes with a dissecting forceps, held in the left hand, a portion of the membrane large enough to bring the cilia to their proper situation, but not so large as to invert them. He then cuts this fold from the greater angle towards the smaller for the right, and the contrary for the left eye: endeavoring not to comprehend in the incision any thing more than the conjunctiva, and to keep nearer to the globe of the eye than to the edge of the palpebra. For the operation straight or curved scissors should be used. A sharp bistoury or a good lancet would serve, but scissors are best. The blood, which flows abundantly at first, soon stops of itself, and the operation, properly speaking, is done. The treatment of the rest is the same as that for an ordinary or traumatic ophthalmia. The cicatrization of the wound brings back the tarsus into its natural position. Paulus Egineta used a thread passed transversely from one angle of the eye to the other, to elevate the conjunctiva for the incision. The scars left upon the skin of the face by burns, small-pox, wounds, or ulcers, often produce an ectropion much more difficult to cure. Desiccatives and caustics applied upon the palpebral conjunctiva afford no relief. It would be in vain to replace the lids with a thread or adhesive strips. The actual cautery, or the excision of the relaxed membrane, is commonly useless. Many operators, even among the moderns, agree in considering the disease incurable. Until the time of Boerhaave and Louis, there were a variety of ways for lengthening the external face of the lid thus everted. Since, with Demosthenes of Marseilles, Celsus, and Pare, made a semilunar incision of the skin, having its horns turned towards the opening of the eye; others contented themselves with a transverse incision, the lips of which they endeavored to keep apart with charpie or some other foreign substance; others again, as Paul of Egina, and Olof Acrel, carefully destroyed all the cicatrices of the skin, either by incision, excision, or strangulation, by means of a ligature. But it is well known, that so far from being advantageous these various methods are almost always injurious, and in spite of every precaution, the resulting sore contracts the teguments of the lid instead of favoring their elongation.

1. *Process of Antylus.*—In 1813, an English oculist, Mr. Adams, proposed a method of operating for these difficult cases, of which he thought he was the originator, but which Mr. Martin attributes to Dr. Physick, of Philadelphia, or to M. Bouchet, of Lyons, and which is found long ago described by Aetius, who refers it to Antylus. A triangular piece of the affected lid, of the form of a V, is to be removed, the base corresponding to the cilia; the sides of the opening left are then united by means of a suture. Mr. Adams's method has been followed in France, by Beclard, and more especially by Roux. I have seen it used, and used it myself several times with success. Antylus, who made his incisions from the adherent towards the free edge of the lid, took care to divide nothing but the conjunctiva, the tarsus, and the orbicularis muscle; in a word, leaving the skin untouched. Mr. Adams and M. Roux first seize

the lid with a ligature forceps, and then cut on each side of it through the whole thickness; thus forming the triangle by cutting from its base to its apex. The blood, though flowing abundantly at first, because the ciliary or palpebral artery is necessarily divided, soon stops. Mr. Adams is contented with a simple stitch near the cilia to secure reunion. Mr. Roux treats it exactly like the hare-lip; that is, he applies the twisted suture with two short strong pins. Instead of a bistoury, I think it would be better to use a pair of good scissors, as I have twice done. With them the operation is more prompt and sure, and the section of the tissues more neat and easy. I see no necessity for making the base of the flap more than two or three lines long, and prolonging it beyond the cartilage.

2. *Process of M. Walther.*—In a case in which the ectropion occupied only the temporal half of the eye, Walther, after having plucked out the eye-lashes, seized the external extremity of the inferior lid with a pair of forceps, and then incised it through its whole thickness to the temple; he did the same with the superior lid, and removed the flap contained within these limits. The lips of the wound being drawn together, were kept in place by two stitches, and the patient perfectly cured. This method is evidently none other than that of Antylus and Mr. Adams, applied to the smaller angle of the eye, and would be applicable only in such cases as the one that came under the care of M. Walther.

3. *Process of Dr. Key.*—In 1826, Doctor Key had to treat a case of ectropion, which Messrs. Travers, Tyrrel, and Green had in vain attempted to cure by the usual method. Imagining that the eversion of the lid in this case might depend upon the spasmodic contraction of the orbicularis muscle, Dr. Key made a transverse incision through the skin, dissected carefully to the convex edge of the tarsal cartilage, directed an assistant to separate the lips of the incision, and then with a forceps seized a fasiculus of muscular fibres, which he divided with a pair of fine scissors. The operation was completely successful. I do not know whether operators can fully adopt Dr. Key's views, nor if I have given them exactly; but this is certain, we cannot comprehend the existence of these pretended spasmodic contractions, nor how the excision of a part of the orbicularis muscle can remedy ectropion. Yet, in surgery at least, when a fact is advanced, whether it be comprehended or not, prudence requires us to admit it. I have therefore felt myself bound not to pass over in silence the operation of the English surgeon.

4. *Blepharoplastic Operation.*—This is an operation very recently proposed, and which two operators have already tried. Founded upon the principles of the Indian rhinoplastic operation, this method consists in excising the cicatrices which cause the ectropion, and in the formation of a flap taken from the cheek for the lower lid, and from the forehead for the upper; fixing it in the place of the excised tissues by means of a suture, and taking care to divide its root about the fifth or eighth day. By this means M. Frick was completely successful on a subject sixty-three years old; but M. Juncken failed completely in the two attempts which he made.

If the ectropion be caused by a tumor of any kind in the interior of the orbit or in the lid, it is scarcely necessary to say that the surgeon should occupy himself with the tumor, and not with the everted lid.

§ 2. *Trichiasis, Entropion, and Blepharoptosis.*

When the superior eyelid becomes so far permanently depressed as to close the eye completely, and the cilia are not inverted; whether it depends upon a relaxation of the elevator muscle or any other cause; if it be of long standing, and has resisted the use of antiphlogistics, stimulants, and other therapeutic agents, either local or general, we are then called upon to oppose surgical means to this *blepharoptosis.*

1. *Excision.*—The operation, which is nearly the same as for ectropion and trichiasis, has been considerably varied. Hippocrates passed two loops of thread through the skin, so that one end came out near the free edge the other near the base of the lid, and tied these extremities together so as to evert the cilia; but the method by incision of a transverse cutaneous flap, has attracted more particular attention. This incision has been carefully described by Celsus and G. de Salicet, and is variously performed. Acrel, who proposed it in his turn, recommended the removal of a lozenge-formed flap. As this did not appear to him always successful, he had the boldness to incise the integuments above the brows, thus removing a considerable segment. Celsus and Galen traced the limits of the portion they wished to remove with ink, and brought them together by a single stitch. Aetius recommends the upper incision to be semilunar, and the lower straight. Instead of one stitch, he employed five. Paul of Egina commenced by a transverse incision of the internal face of the lid, extending from one angle of the eye to the other. Rhazes used caustics. Abul-Kasem used a hot iron or quick-lime, and gave his wound the form of a myrtle leaf. Costeus and Scachi extolled the actual cautery. Recently M. Heling and M. Quadri have spoken highly of sulphuric acid. The Neapolitan professor begins by moderately separating the lids, which he washes, wipes, and dries carefully with fine linen or a sponge. Then, with the aid of a small piece of polished wood, he places the acid upon that part of the skin that corresponds to the lowest portion of the tarsal cartilage, spreading it from four to six lines transversely; waiting some seconds for the first application of the acid to combine with the tissues, he reapplies it a second, third, and even fourth time, or until the lid is slightly shrunk outwardly; taking proper precaution in the mean time that the caustic may not penetrate into the eye.

The excision of the skin and cauterization with sulphuric acid, produce evidently the same ultimate results. By both methods there is a loss of substance. It is necessary that the lips of the wound should approximate, to produce cicatrization; and by this means a contraction or shrinking of the lid, and principally of its external face, is obtained. After making the incision, to which an extent may be given suited to the degree of retraction desired, should we, like those who first employed it, as well as Beer and Langenbeck, have recourse to the simple or quilled suture; or, like Scarpa, content ourselves with plain dressings, and wait for a reunion by the second intention. This appears to me a matter rather of choice than of necessity.

2. *Extraction and Cauterization of the Cilia.*—One of the most ancient methods of curing trichiasis, and especially destichiasis, is the extraction of the erratic hairs. Popius, according to Galen, was its inventor. Nothing

can appear more natural, as a remedy for the pain and inflammation which the eye suffers in this disease, than a removal of the cause. Unhappily, we are soon taught that this remedy is only palliative, curing it only for a while; and that the renewed cilia almost constantly take the former vicious direction. Still it is almost the only plan adopted by Vauguyon, Maitre-Jean, De la Motte, and even Richter, when the tarsus itself is not diseased. To guard against the recurrence of the malady, some operators apply caustic to the roots of the hairs after extracting them. Sulphuric acid, butter of antimony, and nitrate of silver, have been in turn extolled. Seeing that none of these will suffice, some have used the actual cautery, according to the advice of Rhazes. M. de Champesme, in our own times, has found nothing better for trichiasis than an improvement of the cauterization used by many of the ancients. The form of the ancient cauterizing instrument did not allow the heat to be carried sufficiently deep. His is terminated by a point some lines long, supported by a large ball, and resembles somewhat the cautery called the sparrow's head. Heated to whiteness, the point, although small, long retains heat enough to form escars promptly wherever applied. M. de Champesme affirms, that he has many times cured trichiasis radically with his instrument, and no one can deny its advantages when cautery is decided upon.

3. *Eversion of the Cilia.*—A means less cruel, and one which appears to have been attended with some success, consists in everting or turning out the strayed eye-lashes upon the skin of the lid. Heraclide, who passes for its inventor, maintained them in that position, like Acton, by means of plasters. I used this method in a case which resisted the excision of the integuments. Celsus and Galen say, that in their time some persons operated by passing a woman's hair, doubled, through the skin with a needle, in such a way as to secure the erratic lashes in the curl of the hair. According to Rhazes, we may succeed as well by crisping them with a hot iron.

Remarks.—The excision of the skin, so strongly recommended by Bordenave, Louis, Scarpa, and almost all of the moderns, is an operation too simple and too frequently successful, not to be a first resort. The surgeon, placing himself in front of the patient, seizes, with an ordinary forceps, the fingers, or Beer's forceps, a fold of the integuments sufficiently large to return the cilia to their proper place outwards and upwards. If the fold be too large, he exposes himself to produce ectropion; if too small, to an incomplete cure of the trichiasis. It is to be excised in the same manner, and with the same precautions, as the fold of the conjunctiva in lagophthalmia or simple ectropion. After the operation, Scarpa recommends that the skin of the face for the lower lid, and of the brows and forehead for the upper, should be forced towards the orbit, and kept there by graduated compresses or adhesive strips extending from the cheek high upon the forehead. The next day, he says, the patient can open his eye; and if any granulation or fungous growths show themselves, they should be repressed by the *lapis infernalis.* M. Beer and M. Langenbeck recommend the use of the suture, that the eye may be relieved as soon as possible from the effects of the presence of the cilia. As the divided skin is very thin and elastic, as nothing is easier than to take a stitch in it, and as it is always better to unite it immediately without crowding in the neighboring integuments, like Scarpa, I cannot see why there should be any

repugnance to the use of a simple suture, were it but for twenty-four hours, as recommended by Langenbeck.

Avenzoar speaks of some operators who preferred compressing the flap of the integuments between two splints, until it produced mortification. Bartisch has reproduced this idea under another form; he engages the fold between two plates of iron united by a hinge. Adrianson, according to Heister, invented a method still more strange: with an instrument very similar to that of Bartisch's, garnished with holes, he pinched up a large fold of skin; he then passed threads through the base and the holes of the instrument, removed the latter, and tied the threads as so many ligatures.

4. *Excision of the Edge of the Palpebra.*—In some obstinate cases, Dr. Schreger removes, with curved scissors, a triangular flap of the edge of the lid, comprehending the erratic hairs; and even went so far, says Mr. S. Cooper, as to advise the excision of all the inverted portion of the tarsus. But we cannot see in what this method, also eulogized by Heister and D. Gendron, is superior to a simple excision of the palpebral integuments.

a. Mr. Crampton's Method.—After dividing the free edge of the lid to the right and left of the deviating hairs perpendicularly, Mr. Crampton united these two incisions by a third transverse one of the conjunctiva; then drew the included portion of the cartilage to its natural position, and maintained it there by adhesive strips, or other appropriate dressing. Mr. Travers, who has partly adopted Mr. Crampton's views, thinks that in certain cases it would be better to remove the little trapezoidal portion of the tarsus. The physicians of Bimarestan, of whom Rhazes speaks, and who incised the cartilage and pierced it with a thread, with which they everted it; Richter, who advises us to make a transverse incision of the tarsus in obstinate entropion; and Paul of Egina, who advises to cut through the lid by the inner face, have given birth, we see, to the idea on which Mr. Crampton's operation is founded. At best, this is only a resource in extreme cases.

b. Mr. Guthrie's Method.—Mr. Guthrie also cut the tarsus, but near the angles of the eye; with the finger he then everted it towards the forehead, or the cheek, according to the lid affected. If, on being allowed to fall on the eye again, it continue inverted, Mr. Guthrie recommends to divide it transversely, and to remove a portion of it, along with the skin that covers it. Without being good enough to merit great confidence, this method seems less objectionable than the preceding.

c. Saunder's Method.—The surest way, says Dr. Saunders, is to remove almost the whole of the diseased organ. A thin plate of lead, or silver, curved to suit the lid, being first placed between it and the part, the eye being stretched by an assistant, the operator divides the skin and orbicularis muscle, a little beyond, and in the direction of the tarsus, behind the cilia. The inconveniences of such a plan are but too evident. It would be better to follow the advice first given by M. Jæger, of Vienna, and afterwards by M. Flarer, of Pavia, to excise the cutaneous portion of the free edge of the lid, and with it, the erratic hairs and their roots.

d. Method of Vacca-Berlinghieri.—The operation of Vacca seems to me much more reasonable. In a most obstinate case of trichiasis, this surgeon thought he could expose the roots of the hairs, and destroy them, either with a cutting instrument or nitric acid. A thin concave plate, with a transverse

groove upon its convex face, is placed upon the globe of the eye. An assistant holds the lid with the free edge in the groove of the plate. By means of two vertical incisions, one line long, united by a transverse one which comprehends the skin only, the operator forms a small parallelogram, which he turns forwards towards the opening of the eyelids; by this means the cartilage is exposed; he then seeks the bulbs of the diseased hairs with the pincers; excises them with the scissors, or cauterizes them; replaces the flap, and maintains it in place with plasters. The ciliary branches of the palpebral artery are cut, and bleed abundantly; but the hemorrhage is unimportant, and stops of itself. M. Delpech, who also eulogizes the cauterization of the cilia, not of the bulb, but the neck, depends principally upon the formation of an elastic cicatrix, a layer of imperforated tissue, and consequently preferred union by suppuration.

Recapitulation.—In simple blepharoptosis, excision of the integuments is almost always successful. It is also the most efficacious remedy in ordinary entropion. In trichiasis, the turning out of the hairs, after the manner of Heraclides, when their length permits, or of Hippocrates, can be first tried. Then comes, 1st, the excision of the integuments, which Dr. Physick advises to be made very near the free edge of the palpebra, and which I have just seen fail in a very simple case; 2d, cauterization of the skin after the manner of Helling and Quadri, which I have once used with success; 3d, Vacca's method for more serious cases; 4th, and lastly, excision of the cartilage, according to the views of M. Guthrie, Schreger, Travers, Saunders, Crampton; or even by the process of Mr. Adams.

§ 3. *Tumors.*

1. *Cysts.*—If any tumor, occupying either lid, does not disorganize but only deform the lid, the tumor should be destroyed without removing the natural organ. Encysted tumors come under this head. If the vinous solution of the muriate of ammonia, recommended by Morgagni and M. Boyer, should fail, and the patient desires to be relieved of the affection, it is time to think of the operation, properly so called. Ligature, incision, cautery, and extirpation have been proposed. The ligature has been for a long time justly abandoned. Simple cauterization has shared the same fate, at least when not combined with incision. A needle fixed like a seton in the tumor, as recommended by M. Jacquemin, would, I think, only succeed by chance. So that it is only extirpation that is worthy of our attention.

To effect this, it is useless to pass a thread through the tumor, as Bartisch advised, so as to act upon it more securely. When it is small, and has its seat apparently nearer the conjunctiva than the skin, Richter recommends that the offending body be removed by the inner face of the lid, because it then leaves no visible cicatrix after the cure. The great prominence which it presents outwards should not mislead us, for this projection more frequently depends upon the pressure of the globe of the eye than the seat of the tumor. The cures are therefore very few—when the skin is altered and thinned, for instance, or when it is too difficult to evert the lid, in which we are obliged to divide the external integuments.

First Process.—With the thumb upon the inner face of the tarsus, and the

index finger applied upon the skin, the surgeon takes hold of and everts the lid; then, pressing upon the tumor to give it prominence, he lays it bare with a transverse incision, seizes it with a hook which he confides to an assistant, and then with a bistoury dissects it out. The small wound resulting requires very little care; cicatrization takes place in a few days. When the tumor is secured by the hook, if it be small and easily raised up, it may be removed by a single cut with a pair of flat curved scissors. Yet it is important to preserve the conjunctiva and subjacent tissues, because their destruction exposes the patient to entropion.

Second Process.—When from necessity or choice we would remove the tumor through the skin, the index finger takes the place of the thumb, and the thumb the finger. By pressing the tumor, the finger stretches the lid, and protects the eye much better than the cupola of lead or silver formerly used, or the plate of lead, gold, or copper, still recommended by Chopart and Desault. The integuments are then cautiously dissected, to prevent the opening of the morbid body. The rest offers nothing particular. Short strips of taffeta or diachylon plaster maintain the lips of the wound in contact, and we have rarely to wait more than three or four days for a cure.

Care should be taken in both these processes to avoid cutting through the lid, or wounding if it can be avoided the tarsal cartilage; because it may retard the cure, and even produce a fistula, or some other deformity.

Modified Cauterization.—Maitre-Jean, Heuermann, and Nuck, commenced by opening the tumor freely so as to empty it, and then applied the actual cautery to its interior. Chopart and Desault, who professed the same opinions, used a pencil of *lapis infernalis.* M. Dupuytren, in adopting this plan, founds his preference upon its greater ease and security—preventing a perforation of the lid; and upon its being the only one that can be used, when in spite of all precautions the cyst has been opened in endeavoring merely to expose it. The operation is very simple. The organ is held as in the preceding methods. With one stroke of the bistoury we divide the skin and the little sac, which empties itself, or should be emptied; its whole inner surface is then cauterized with a stick of nitrate of silver, pressed upon it with some force; the heterogeneous crust soon comes away, and the wound heals quite readily. All things equal, excision is to be preferred. But M. Dupuytren's method is hardly less advantageous, and would be very applicable upon refractory subjects. I have employed both with equal success.

Cancerous Tumors.—Experience has sufficiently proved that cauterization is a bad means of destroying cancerous tubercles of the eyelids. If the tumor be of a less alarming nature, still it is better to attack it with the cutting instrument if the degeneration has extended to the natural tissues. Here, as elsewhere, it would be better to do nothing than leave a portion of the disease for fear of cutting into healthy parts. When there exists but one tubercle well defined, occupying only the border of the tarsus, it is best to isolate it by means of two incisions uniting in a V, thereby removing a triangular flap with it; using the twisted suture to bring together the edges of the wound. If the alteration be more extended transversely than vertically, so that after extirpation we should think it impossible to bring together the edges of the incision, we should then make a semilunar incision of greater or less length and depth, either with a good bistoury, or, as M. Richerand prefers, with curved scissors;

taking all possible care not to injure the lachrymal puncta or conduits. The solution of continuity cicatrizes by suppuration. The integuments slowly increase upon the eye, and terminate by forming a kind of hood, which partially replaces the lost lid.

§ 4. *Anchyloblepharon and Symblepharon.*

The adhesions that occur between the lids and globe of the eye have been long observed. To destroy them Heraclides used a bistoury, recommending the edge of the instrument to be inclined rather towards the lid than the globe; and to prevent the reproduction of the disease, advises the patient to move the eye frequently in every direction. When the adhesions are weak, or small in extent, it is sometimes possible, as Alex directs, to destroy them with a sound or stylet. If they assume the form of bridles or lamellæ, beyond which a grooved sound may be passed on the globe, they may be divided, according to the advice of Maitre-Jean and M. Boyer upon this instrument, without danger. No one now, as in the days of Bartisch, thinks of raising the lid with a thread or ligature to dissect it from the ball. The most important matter is, not to break these connexions, but to prevent their reproduction. The constant motion recommended by Heraclides, the plates of lead, gold, or copper, recommended by Solingen and others to be placed between the eye and lid, but rarely accomplish this purpose. The best plan is to pass from time to time a ring or a large pin-head between the contiguous surfaces, so as to cause them to cicatrize separately. It is an operation after all which should only be attempted upon those who have a healthy transparent cornea, or at least those whose cornea is in that state in the part opposite the pupil.

Congenital or acquired adhesion of the edge of the lids, always less important, may be complete or incomplete, and may exist alone or in conjunction with the preceding disease. In the first case, instead of opening with the bistoury the whole extent of the line which the natural state should present from before inwards, we should make a small opening near the temple, in order to introduce a grooved silver probe, a little concave on its back, that it may accommodate itself to the convexity of the eye. The bistoury, guided by this conductor, is passed without danger from one palpebral commissure to the other in the track made by the junction of cilia. In the second case, the preparatory incision is unnecessary. After separating the lids, if there exist anchyloblepharon, it should be destroyed according to the rules abovementioned. Instead of the bistoury and sound, it is possible to use a pair of scissors, guarded by a small ball of wax, as recommended by J. Fabrice, or a small button, as advised by Scultet, at the end of that blade which is to pass next the ball of the eye. But it would be trifling to pass a wire of brass behind the abnormal connexion and bring together its two halves, like Duddell, in order to separate the adhesions insensibly. Nor would any person expose himself to the ridicule of imitating F. de Hilden, who tied the two extremities of this wire together, and attached to it a weight to draw it out by degrees. As after every method the disunited edges retain a great propensity to reunite, the surgeon should not omit to place between them some pieces of charpie covered with cerate, near the commissures, nor to separate them frequently with a wire or ring of gold or silver.

Encanthis.—Scirrhous, or other degeneration of the caruncula lachrymalis and the greater angle of the eye, can only be cured by extirpation. This is an operation which the proximity of the sac, the conduits and puncta, as well as the globe of the eye, renders very delicate. An assistant placed at the back of the patient is charged with keeping the lids apart. The operator, placing himself in front, seizes the tumor with a hook or a pair of forceps, and dissects it carefully with the point of a sharp bistoury, first from below, then within, then towards the eye, and then from above, penetrating as far as the disease requires, and removing it as quickly and completely as possible. It was thus that Marchetti detached a melicerous tumor that covered even a part of the cornea; but he had recourse to the scissors to complete the operation.

Orbital Cavity.

Lupi, encephaloid masses, &c., may develop themselves in the interior of the orbit. The lachrymal gland sometimes acquires a considerable size in passing into the scirrhous state. These various lesions, whose peculiar characteristics are, the projection of the globe of the eye from the socket, and its inclination at the same time in a direction opposed to the side where the tumor exists, most frequently require the extirpation of that organ. Yet, whenever it is not itself implicated in the degeneration, we can save it. This is proved by a beautiful operation of Acrel, and the practice of Dupuytren. An old work of Daviel and Guerin, of Bordeaux, recently published, proves also that the lachrymal gland had been often successfully extirpated by these two surgeons. There are even osseous tumors that may be removed without injury to the eye, either with a chisel and mallet or well directed traction, as is proved by a fact related by M. Saltzen. The rules for the extirpation of the lachrymal gland, or any other tumor in the orbit, must necessarily vary with size, form, nature, and seat of the disease. If, for example, it were a cyst, full of more or less liquid matter, it would be sufficient to pierce it with a bistoury, and keep the cavity open by means of a tent of charpie. M. Schmidt and Rutdhorffer, who have often seen such cases, think that even a puncture with a trocar is sufficient. Guerin, of Bordeaux, in endeavoring to extirpate the lachrymal gland, or a cancer, acknowledges that, after passing the lids, he came upon a tumor filled with semi-liquid matter; he opened and emptied it, and introduced a tent; and, in twenty-one days, the cyst came away. Spry, who made a similar mistake in 1755, might probably have saved the vision of the patient, if, instead of continuing the extirpation of the eye, he had had the prudence of M. Guerin.

As to solid bodies, there are two methods of removing them:—

1. *Acrel's Method.*—The lid is to be divided through its whole thickness near its base, in a direction corresponding to its natural curve, and over the most projecting part of the disease; an assistant separates the lips of the incision; then, with a narrow bistoury, directed by the index finger of one hand, the surgeon detaches the tumor from the orbit, seizes it with a hook, dissects its internal face so as to separate it from the eye with the finger of the cutting instrument, and tries to turn it from its summit towards its base. Daviel and Guerin followed this method with success. Although in one case the tumor presented on one of its faces a groove moulded upon the optic nerve,

and in another, the operation was followed by an enormous swelling of the lids and high fever, they succeeded in preserving the sight. At first, we might doubt if the lachrymal gland itself had really been extracted; but Guerin dissected one after an operation, and even made a plaster model of one, the original of which he exhibited, preserved in alcohol, at the Academy of Surgery. It is, besides, at the present day a well-known operation. Messrs. Todd, Lawrence, and O'Beirne have recently practised it in England with not less striking success than Daviel and Guerin. M. Mackensie's treatise acquaints us with two other examples, and Warner as well as Travers has performed it. The method they used, however, is not free from objections.

2. *Another Method.*—It seems to me that the end would be better attained by prolonging, at the commencement, the external commissure towards the temple, so as to enable us to evert the lids. Some experiments on the dead subject have convinced me that by this means we may very easily expose the two external thirds of the orbital circumference. This being done, the surgeon separates the tumor which he wishes to remove from the bony cavity that encloses it, by dividing the cellular tissue from its external face; then dissects down to its greatest depth, and detaches it, with the utmost caution, from the muscles, the optic nerve, or the globe of the eye, and removes it with the finger or hook. Occasionally the operation is followed by a swelling so great, as to make the eye appear after three or four days as prominent as before; but this is not long in disappearing. In the space of from ten to thirty days every thing assumes its natural position, and the cure is commonly complete.

Union by the first intention should not be attempted after either process, because the cavity left in the orbit cannot be immediately filled, and because the tissues which have been torn rather than cut, must unavoidably suppurate. In one case in which the incision closed too soon, Guerin observed such alarming symptoms, that he was obliged to destroy the cicatrix with a sound. It is, therefore, sufficient to dress with a pledget, or tent of lint covered with cerate, to draw together the incision of the palpebral angle, if such have been made, and cover the whole with a pledget and compress supported by the suitable bandage. When suppuration is established, the dressings should be renewed every day. Injections are often necessary, and every thing should be done to make the cavity fill from the bottom. If by cutting through the lids the operation can be made more easy, it should be preferred, although the deformity it produces be so much greater; but unless the tumor has acquired great size, this is not the case. In a case that fell under the notice of Mr. Hope, a tumor of seven years' standing had so elongated the optic nerve, that it was necessary after its removal to press the eye back into its place with the hand, and maintain it there with a bandage. Success was nevertheless complete. In the case of a young woman who was utterly intractable, Mr. Wardrop abstracted fifty ounces of blood in order to produce syncope, during which he performed the operation with such facility and success, that the patient on reviving could scarcely believe her eyes.

Art. 4.—*Globe of the Eye.*

§ 1. *Foreign Bodies.*

A gold or silver ring, the head of a long pin, a small roll of paper, an ear-pick, or any other smooth and rounded instrument, is sufficient to remove the various solid foreign bodies that remain loose beneath the lids; but these will not always serve for particles of metal, stone, wood, &c., which, having been projected against the eye, become fixed. Then, if there be no fear of injuring the eye, a quill cut into the form of a tooth-pick, or some other such instrument, will often answer the purpose. In other cases we must have recourse to the point of a lancet, and in some others, even have to use a pair of small forceps or pincers. It is only in rare cases, when the particle of iron is scarcely at all attached, that the magnet, recommended by F. de Hilden (who highly extolled its success in the hands of his wife), can be advantageously employed. The same may be said of a stick of sealing-wax or amber, for removing particles of straw, chaff, &c. When an operation has been decided upon, an assistant is charged with keeping the lids apart; with the point of a lancet, or very pointed bistoury, the surgeon isolates the foreign body from the cornea to a certain depth; then lays hold of it with a pair of fine and accurate forceps, and removes it carefully for fear of breaking it. The subsequent treatment is the same as that for an ordinary ulcer, or simple ophthalmia. It is an operation that presents little difficulty, requiring only address and great precision in the movements. When the body to be extracted has sunk deep into the coats of the eye, without penetrating into the chambers, we may almost always succeed in removing it by means of the edge or point of a lancet.

§ 2. *Pterygium.*

When proper medicinal applications have failed to dissipate pterygium, and it advances upon the cornea so much as to cause the loss of sight, it should be removed with the bistoury or scissors. The division of the vessels that supply it, as recommended by Beer; strangulation by means of a thread passed between the conjunctiva and sclerotica, which la Vauguyon preferred; and cauterization, have all been more than once successful; but as all these means are fallible, and more difficult than excision, they are generally abandoned.

To remove it, the operator takes hold of it with a pair of forceps at one or two lines from its point. By drawing it a little towards him, as if to detach it, he soon hears it make a slight crack like a piece of parchment. Then it is easy to cut it away from point to base, or in the contrary direction, with a bistoury or small scissors. As the cornea but rarely regains its transparency opposite the cut, M. Boyer recommends, I think properly, that when its point has reached so far as the pupil, not to extend the incision so far as that, but to excise only its posterior four-fifths. Emollient lotions for some days, then such resolvent applications as are used in all the chronic phlegmasiæ of the eye, constitute the consecutive treatment.

When the pterygium is not very thick, Scarpa thinks it will be most fre-

quently sufficient to excise a semilunar flap of it opposite the point of union of the sclerotica and cornea, and that in other cases it should be destroyed entirely; but to escape a disagreeable cicatrix, that the point should first be detached, and then the base, so as to terminate the operation in the middle. But I do not think this last precaution of much importance, and the partial excision, which I have tried three times, has always failed. It is prudent in every case to follow the advice of M. Boyer to forewarn the patient that, notwithstanding the operation, he may not be perfectly cured, because a kind of opacity but too frequently follows.

§ 3. *Cataract.*

1. *History.*—Although, from the days of Celsus (who was the first to speak clearly concerning it) to the present day, it is known that but few cases of confirmed cataract have been cured any other wise than by an operation, yet it would be wrong to deny absolutely the efficacy of all other means of treatment. Those which occur upon scrofulous, scorbutic, or syphilitic subjects, or are caused by an inflammation, or some other disease of the parts contiguous to the eye, have more than once either spontaneously disappeared with the original disease, or from the influence of a well-directed local and general treatment; of which Maitre-Jean, Callisen, Alberti, Gendron, Murray, Richter, Ware, and many others have cited examples. Henbane applied to the eye, according to Nostier, and a seton at the nape of the neck, with M. Champesme, have quite recently triumphed over cataracts very far advanced. M. Dietrich recommends that it should be arrested in its development by repeated puncture of the eye; and M. Schwartz has cured three cases by means of revulsives, &c. Like Messrs. Rennes, P. Delmas, and Manoury, I have seen it disappear spontaneously. Messrs. Larrey and Gondret affirm that they have obtained the same result from moxas, actual cautery, or ammoniacal pomatum, applied upon different parts of the head, especially the sinciput; but to judge properly of the value of these, it is necessary to have certain proof that the alterations which have been made thus to disappear were true cataracts, and not that which is now known as the false cataract.

Although Galen and the Arabians had indicated the nature of cataract, some centuries passed before it became generally known. The pellicle that constitutes the disease is placed by Celsus between the iris and the lens; on the contrary, G. de Chauliac, G. de Salicet, &c., place it between the iris and cornea. That which contributed most to maintain and propagate such errors, was the generally conceived opinion that the lens itself was the seat of vision. However, when Kepler showed, in 1604, that the lens was only a refracting agent, a prompt revolution in favor of truth occurred on this point of surgery. Gassendi, who wrote in 1660, as well as Palfyn and Mariotte, attributes to R. Lasnier, or F. Quare, the honor of having first contended that cataract does not depend upon an accidental pellicle, but upon the opacity of the lens. Schellamer learned it of a surgeon of the *Hotel Dieu.* Brisseau, Mery, P. du Petit, Borel, Tozzi, Geoffroy, Albinus, Bonnet, and Freytag, doubtless obtained it from the same source. We owe to Maitre-Jean, however, the settlement of the question beyond dispute. But in escaping from one error, surgeons were on the point of falling into another. Instead of not seeing the cataract

in the lens, they nearly passed into the other extreme, of never seeing it any where else. Ph. de la Hire, Freytag, Morgagni, had much difficulty in persuading the profession that this disease may also be produced by the opacity of the capsule. It was reserved to S. Muralt, Didier, Heister, and Chapuzeau to put beyond question that it is always produced by the opacity of the lens, of its capsule, or of the matter in which it lies, and not by either one of these exclusively. From the highest antiquity surgeons have attempted the destruction of cataract by certain instruments. Celsus even gives us to understand that, among the physicians of Alexandria, there were many, amongst the rest a certain Philoxemes, who had acquired great skill in this particular.

2. *Conditions.*—If the cataract be simple, if it be situated in the chrystalline, or have contracted no adhesions to the neighboring parts, if the iris retain its faculty of contracting and expanding, if the patient can still distinguish light from darkness, if there be no inflammation either of the eye or within the orbit, if there be no cephalalgia, catarrh, nor general disorder, if the eye be neither too prominent nor too sunken, if the patient be not too much advanced in years, if he be quiet enough to submit to all the necessary cares, then the chances of success are as numerous as one can desire. When, on the contrary, the patient is wasted with age, there exist nebulæ of the cornea, the pupil unchangeable, the bottom of the eye is of a greenish hue, there are frequent or permanent deep-seated pains of the eye, and a chronic ophthalmia, or some other chronic disease difficult to cure, and more or less serious, exists in the neighborhood of the eye, then we should not count upon success. In other words, whenever the lens and its capsule alone are diseased; when, except the cataract, the organ is in a natural state, and when the orbit contains nothing that can prevent the restoration of vision; whether the cataract be true or false, lenticular, capsular, or capsulo-lenticular, membranous, anteriorly or posteriorly, hard or soft, milky or chalky, permanent or movable, star-like, pearly, three-branched or central, purulent, putrid, spotted, or reticulated, marbled, dry or husky, bloody, stony, yellow, brown, or black, the operation may be recommended. But in other cases it should never be tried but as a last resort, and after notifying the sufferer of the little chance of success. Still we should not be too much alarmed by appearances. The immobility of the pupil is not more certainly a sign of amaurosis, than its mobility is of a healthy state of the retina. Wenzel, Richter, Larrey, Watson, S. Cooper, &c., have shown us that the adhesion of the iris to the capsule of the lens, or the contraction of its opening after iritis, can leave it immovable, as well as a paralysis of the retina can leave it the contractile power. Certain subjects who could not distinguish day from night, have, after the operation, recovered their sight. The black cataract observed by G. de Chauliac, Morgagni, and Freytag, and of which Maitre-Jean Pellier, Arrachard, Wenzel, Coze, Cloquet, and Riobe have given us examples. is too rare, even supposing that it can exist without changing the tint of the pupil, to arrest an intelligent operator. In a word, when no organic lesion nor serious symptom renders the operation dangerous, I cannot see why, if the patient be completely blind, we should refuse to attempt the operation. The patient can lose nothing, and if he have but one chance in a thousand of recovery, it would be inhuman to withhold that one. Nevertheless, we should absolutely abstain from operating when there is a certainty

of deep-seated alteration of the eye. In a man in this state, and to whose entreaties I at last yielded, the lens escaped gently of itself, enveloped in its capsule some moments after opening the cornea, when the vitreous humor showed itself so fluid, that it would have escaped like water if I had not instantly applied some compresses of lint upon the eye. Some cerebral disturbances followed, and even so serious for several days as to give me much inquietude. The left eye is filled with pus, and the right, although perfectly clear, remains insensible to light. False cataracts, which are almost always complicated with affections of the iris or some other membrane of the eye, are less easy to destroy than the true ones. All things equal, the cataract of the lens itself is not so bad as that of the capsule, or of the liquor Morgagni. In children, although the operation is difficult, we succeed better than in adults; and after that, in a ratio with the distance of the subjects from decrepitude.

3. *Ages.*—Almost all authors think, with Sabatier, that the operation should only be attempted on those who can know its utility, and that is, that it should not be used before the tenth or fifteenth year for instance. The indocility of children, the little desire they evince to see the light, the dangers to which they are exposed in the attempt to operate against their will, and the difficulty of making them submit to the necessary precautions, are the principal motives upon which this doctrine has been established. At the present epoch it is not to be admitted. If the operation be more delicate and hazardous in infancy, the membranes of the eye are also more tender, thinner, and less dense, and more easy to penetrate; the eye is less movable, the pupil larger, and the subjects, fearing only the pain, do not trouble themselves about what follows. As the operation is rarely attended with acute suffering, I can see nothing very alarming in such cases. Besides, it is always possible to confine the youngest subjects, and to separate their lids. The eye is an organ essential to the development of intelligence, and the source of the greatest number of ideas. If its functions are abolished from birth, its development commonly remains incomplete; it acquires slowly an excessive mobility, that renders the operation much more delicate, and lessens the chances of success. In a word, when we think of its importance to the education of children, it is really difficult not to admit, with Ware, Lucas, Saunders, Travers, Beer, and Jager, the necessity of destroying the cataract as soon as possible. Yet, I do not therefore think that we should choose the age of two years, as Farne recommends, nor of six weeks, like Lawrence, rather than one or three years. In old men, as the disease is almost always a natural consequence of age, the operation is not permitted unless it be ardently desired, and the patient be in other respects in the best possible condition. I have, however, just performed it for a subject eighty years old, with a success which we are far from always obtaining in younger subjects.

4. *Simple or Double.*—When the cataract occupies but one eye, there are some operators who object to operating. With one eye perfectly sound, the subject, they say, sees almost as well as with two; well enough, at least, to move about, read, and fulfill, in fine, all the duties that society requires. In this case an operation might, by producing inflammation, affect the healthy eye, as M. J. Cloquet has seen, and produce a complete blindness. But, provided it succeeds, the luminous rays not falling on both retinas

harmoniously, the discordance is necessarily followed by confusion of vision. To these reasons it may be objected, that if the healthy eye sometimes inflames and is lost after an operation, it is an accident that but rarely happens; and that sight is undeniably better with two eyes than one, and that the presence of a cataract on one side seems to have an agency in producing a second on the other. As to the difference which it was supposed would exist in the field of vision, after the removal of the cataract, experience has now demonstrated that it is not manifest. Maitre-Jean, Saint Yves, Wenzel, &c., relate some observations in which they make no mention of it, although they had under their care patients on whom they operated only on one side. I have published some facts of the same kind, collected in the *Hopital de Perfectionnement.* M. Lusardi writes me that he possesses many such; and, in fine, M. Roux, who has often extracted the cataract when it existed only on one side, has not seen that the patients needed any thing else after it than glasses of a different form for each eye. Consequently, if the subject be young and healthy, and he urgently desires it, the operation should be performed, although one of the eyes be perfectly sound.

Cataract commonly exists some time in one eye before completing itself in the other. In this case, should we wait, or would it be better to operate as soon as the first is completely formed? Many recommend, that we should temporize until the second eye distinguishes objects confusedly. They found their advice upon the fact, that the operation may not be followed by success, and may aggravate the state of the other eye so much, that the patient will be worse after than before the attempt. But supposing it may be successful, and, as has been often observed, this same eye should lose its powers again after some years, the other treated in the same manner offers another resource. I know not how far this reasoning may be good; but this is certain, that a cataract once formed cannot remain in the eye with impunity, and that the subject of it in one eye has much difficulty of comprehending the advantage of waiting for the attainment of the same state in the other; therefore, if vision is so far embarrassed in the second eye as to induce the sufferer to call upon us for our assistance, it would be inhuman, in my opinion, to refuse it to him.

Formerly it was admitted that cataract passed through different degrees of consistence; that it was soft and diffluent at first, and became, slowly, firm and solid; in a word, that it could be ripe or unripe. It is now known that cataract may be solid at the commencement, and become liquid after the lapse of many years: the very reverse of what the ancients thought. Yet, it is not the less true that the contrary is often observed, and that the idea of its maturity or immaturity is not altogether without foundation. As it is almost always the result of an internal morbid cause, cataract is really only complete, when that cause ceases to act upon the eye, in which the opaque body holds the same place as a necrosis in some other part of the system; that is, it becomes a foreign body. It is not, therefore, because it is too soft or too hard, that it is prudent to await its complete development; but rather because, its progress not being completed, there is less chance of success then than at a more advanced period, when its formation is entirely finished.

Scarpa, M. Dupuytren, and many other able oculists, have advanced the opinion that it is better, when a cataract occupies both eyes, to operate first

on one side, and wait for a cure, before attempting it on the other. If it succeed, the patient may content himself with it, if the eye do not become too weak; if it fail, there is left another resource. The sufferer bears the second operation more firmly than the first. When the two eyes are operated upon at the same time, the inflammation of one almost always aggravates that of the other; reaction is more lively, and the risk of unpleasant consequences much greater. Messrs. Boyer and Dupuytren observe on this subject, that a double ophthalmia, once developed, rarely fails of fixing itself permanently upon one eye, where, changed in some manner from what it was, it terminates most commonly in the destruction of the organ. All this is somewhat doubtful, and as the single operation, even in the happiest cases, but incompletely restores the sight; as patients prefer bearing the two operations in immediate succession to leaving a long interval between them; as an operation on the one side sometimes determines inflammation on both, and as the double operation offers numerous favorable chances for one, at least, if not both of the eyes, I conclude, with Wenzel, Demours, Forlenze, Boyer, Roux, &c., that, all other things equal, it is better to adopt the latter.

5. The *Preparations* to which the ancients subjected the subjects of this disease, are almost entirely abandoned by the moderns. At present, a more or less strict regimen for some days, venesection, some laxative or gentle purgative, diluent drinks, or calming and anti-spasmodic preparations are employed, according as the patients may give signs of plethora, disorders of the digestive functions, or excessive irritability of the nervous system. As a means of preventing inflammation, some make use of a vesicatory, or some other derivative, upon the skin. Scarpa applies it upon the nape of the neck, fifteen days beforehand. M. Roux on the same place, just at the time of operation. M. Forlenze preferred it upon the arm. I doubt if it be not more dangerous than useful. Many operators dispense with it apparently without disadvantage. Adopted generally, it must be often injurious. In the first few days, it sometimes produces fever, heat of the skin, irritation, and other consequences dangerous to the eyes. If it should be placed upon the neck, then it would be well to follow the advice of Scarpa and Dupuytren, who, when they thought it appropriate, allowed an interval of fifteen days between its application and the operation. Upon the arm, it is very evident that it may produce no inconvenience, but on the other hand, it does not seem to promise the least advantage. As to myself, I use it after the operation, provided particular circumstances require it, nor can I see that this plan offers any thing reprehensible.

6. *Seasons.*—Spring and autumn have been chosen as seasons more favorable to the success of operations for cataract, than summer and winter. These periods have certainly some advantages for the patient, but less on account of the seasons, properly speaking, than because of the temperature, which is commonly more mild and more regular then than in the other parts of the year. Yet, as these conditions may be met with or secured at all times, the operation may, strictly speaking, be performed at any season. However, a decision should be made with great care, if there exist any serious epidemic at the time, especially if it affect particularly the mucous membrane. If catarrhal affections, ophthalmias, measles, or even erysipelas exist, prudence dictates that we should abstain from operating.

Methods of Operating.

The opaque lens is either depressed, that is, placed in such a situation that it will disappear under the influence of the laws of the organization, or it is removed entirely out of the eye. These constitute the two methods.

A. *Depression.*

The first method, known by the name of *depression*, is performed in different ways. It takes the name of *scleroticonyxis*, when the needle is passed between the iris and vitreous body; *hyalonyxis*, when passed intentionally through the hyaloid membrane, and that of *ceratonyxis*, when passed through the anterior chamber and cornea.

1. *Preliminary Attentions.*—On the eve of the operation, the patient, who should have taken but very light food, should receive an injection, if his bowels be not very free. An aqueous solution of the extract of belladonna instilled between the lids of the eye an hour before, obliges the pupil to dilate largely, allows us to follow with the greatest security every movement of the needle, enables us to avoid the iris, and to push with less difficulty into the anterior chamber some portions of the cataract, when it may be deemed necessary. The irritation that the application produces is too slight to require notice. The momentary paralysis which it causes soon disappears, without affecting the functions of the organ. The advantages which it furnishes are of the highest importance, and not to be sacrificed through any idle apprehensions. With irritable or timorous subjects, whose eyes are very unsteady, it is well to accustom the organ to the contact of foreign bodies; touching it frequently for several days with a blunt instrument of some kind, or with the finger.

The *Apparatus* consists of two needles at least, so that if one fails us, the operation may be continued with the other; of a cap or band that will exactly embrace the head; a rolled bandage two or three ells long and two inches wide, to secure the cap; a long compress to cover the sound eye, whilst operating on the other; some oval pieces of fine linen, cut full of small holes, to be placed over the eye after the operation, to prevent the lint from immediately touching the lids; a bandage, folded double, long enough to pass round the head, and of from four to five fingers in breadth, offering at the middle, near its edge, an incision like a T inverted, to receive the nose; and a bandage of black taffeta to cover this last; then a good sponge, warm water, and pins; the whole to be disposed in the order in which they will be needed.

Instruments.—As it is more especially for extraction that the speculum, elevators, and ophthalmostats have been proposed, I shall say nothing of them here. In the needle there is the greatest variety. That of Celsus was shaped like a lance-head, straight, and two inches long. Later, a round one was found more convenient. Then came the triangular form. In fact, almost every operator has his own. Scarpa's, which is only eighteen lines long, is terminated by a point a little enlarged and curved in the arc of a circle, plane on its convex side, ground to a rounded edge, or rather ridge, on its concave

side, and, like all others, mounted upon a handle, having on its back a mark of a different color. M. Dupuytren rejected the kind of crest found on the concave face of Scarpa's needle. He made his smoother on this side than on the back, so as to embrace the lens more securely, and not expose it to being divided in the attempt to sink it to the bottom of the eye. He also recommends that it should have less breadth, and that its shank should be slightly conical, so as to keep the way opened by the point constantly filled, in order to prevent the escape of the humor of the eye during the operation. The point of the one adopted by M. Bretonneau, though short, is as large as that of Scarpa's; its shank, of cast-steel, is more slender, and almost cylindrical, and passes freely and without the least effort through the puncture of the sclerotica. This is an advantage which M. Dupuytren's does not offer, but which exposes the eye to lose some of its fluids. Beer's needle, which many of the German oculists use, is straight and lance-shaped, differing from M. Bretonneau's in having its shank conical and thicker. Hey exhibited one which was not more than ten or twelve lines long, approaching more the form of a chisel than that of a needle. It is a mere modification of Hilmer's, which is conical, and its free extremity, flat, terminated by a semilunar convexity, is the only cutting part. Its sides, straight and round, and its want of point, render it difficult to wound the iris in pushing it towards the pupil; whilst its flattened form renders the depression of the lens less embarrassing. But with this instrument it is almost impossible to destroy a membranous cataract, or even to make a suitable opening in the anterior capsule for the escape of a lenticular one; and as the laceration, for which the inventor more especially intended it, can be very well effected with any other needle, there is no reason for preferring this. Messrs. Græfe, Langenbeck, Himly, Schmidt, &c., have each modified the needle to suit himself. But that is not the difficulty. In the hands of a good operator all are good. Scarpa's, Dupuytren's, and Bretonneau's as much so as the rest.

2. *Operation.*—Up to the eighteenth century the patient was made to sit astride of a bench. Barth and Arnimann preferred to have him standing. Poyet, A. Petit, and Dupuytren recommend the horizontal position. In France the subject is generally placed upon a firm and solid chair of medium height. Beer recommends a stool, whilst Richter prefers a chair with a perpendicular back. In England a musician's stool has the preference. There is nothing settled upon this point. Although the horizontal position is evidently best, yet the others may be used without inconvenience.

a. Ordinary Method.—The surgeon either places himself facing the patient upon the same bench, with his knees between the latter's thighs, and a pad to support his elbow, as recommended by J. Fabricius, or standing, like Dubois, Dupuytren, and many others, or seated upon a chair somewhat elevated, with the foot upon a stool, and a cushion on the knee for the elbow, as prescribed by Scarpa. If seated, we have greater certainty in the movements, because the elbow is supported; but standing we have more freedom and ease. The operator, therefore, may be left to choose the position that best suits his taste or address.

Some surgeons, dispensing with assistants, separate the lids themselves. Barth operated in no other way. Mr. Alexander, who is much extolled for his skill in this method in London, is surpassed, we are told, by M. Jœger, in

Germany. The thing is possible, no doubt; but neither tricks of dexterity nor imprudent boastings make a rule. Nothing in surgery stands more in need of an assistant than the operation for cataract. It is necessary that he should have a light hand, comprehend perfectly every step of the operation, every movement of the operator, and have had as much previous practice as possible. Placed behind the patient, he, with one hand, embraces his head and brings it against his own breast for support, while he elevates the upper lid of the eye with the other. If an instrument should be preferred to uncover the eye, the double hook of Berenger, or the crotchet of some others, can be very well replaced by the elevator of silver wire of Pellier. In general the finger is best, whether, as with Scarpa, it be used to elevate and keep the free edge of the lid against the arch of the orbit, or whether, as advised by Boyer and Roux, it be sunk to the posterior edge of this arch by bending the last phalanx of the finger. By the latter method the lid is more firmly secured, but the angle formed by the phalangeal articulation interferes more with the operator, and the eye runs greater risks of being compressed. Forlenze was in the habit of drawing all the palpebral teguments towards the brow. By this means the ciliary border and the tarsal cartilage are raised as high as possible, and the skin escapes less easily from under the pulp of the finger. A means more sure of preventing the latter is, to place a little piece of fine dry linen between the finger and the integuments to absorb the moisture of the two contiguous cutaneous surfaces. If the patient be in a recumbent posture, the surgeon, placing himself on the right side for the left eye, and on the left for the right eye, puts on the cap and fixes it with the band; covers the eye on which he is not to operate with a little lint and the long compress, which is passed obliquely around the head. The assistant, standing or sitting on a chair at the bolster of the bed, prepares himself to elevate the upper lid. With the index finger corresponding to the diseased side, the operator depresses the lower one and fixes the eye. With the other hand he holds the needle in the manner of a pen; carries the point of it perpendicular upon the sclerotica at a line and a half or two lines from the cornea, a little below the transverse diameter of that part; turns its concavity downwards, and one cutting edge towards the cornea, the other towards the orbit, in order to penetrate by separating rather than cutting the wall of the eye, inclines the handle at first downwards and forwards, and elevates it again in the opposite direction as it passes into the posterior chamber; the last two fingers of the hand resting meanwhile between the parotid and cheek bone. Before sinking the instrument any deeper, it is turned upon its axis so as to present its concavity backwards, that it may pass without risk, first under and then before the lens, penetrating inwards and forwards, without touching the iris or the capsule of the lens, if possible, through the pupil into the anterior chamber; then the point, with a kind of circular motion, is applied repeatedly upon the anterior face of the lens, until its envelope is torn up as completely as possible. This done, the surgeon applies the axis of the needle upon the anterior face of the lens, pushes it with a swaying motion downwards, outwards, and backwards into the depths of the eye, below the pupil and the vitreous humor, where he holds it for half a minute to prevent its disengaging itself; then withdraws the instrument gently by slight rotatory movements; gives it again the horizontal position; turns its convexity again upwards, and withdraws it the same way it had been introduced.

Remarks.—Several points in this operation merit particular attention. If the needle be carried above the transverse diameter, as some operators propose, it becomes almost impossible to depress the lens freely, or to avoid leaving it more or less near to the centre of the eye. By applying it upon the external extremity of this diameter, the surgeon cannot fail of wounding the long ciliary artery, and producing an internal hemorrhage; therefore the lower point should be selected. When the convexity of the instrument is turned forwards, as Scarpa recommends, the fibres of the sclerotica, as well as some of the ciliary nerves and vessels, are necessarily divided; while nothing of the kind takes place if the preceding precepts are followed.

J. Fabrice taught that the needle should be entered at the junction of the cornea and sclerotica. Others, with Purman, say a half line from the former; some at a line and a half; many at two, two and a half, and three lines. There are some who say the breadth of the straw, the middle of the white of the eye, &c. Those who prefer such a considerable distance, are fearful of wounding the ciliary circle or processes. Among others, there are some, who, like Platner, dread injuring the tendon of the abductor muscle, or the sixth pair of nerves. The object of Fabricius in going so near the cornea was to arrive more directly in front of the cataract, whilst most others are more careful to avoid the retina. But as to the truth in this case, two things are certain: that the pricking of the tendon of the straight muscle produces no inconvenience; and that the wounding of the retina is inevitable, when we penetrate through the sclerotica, whatever may be the distance from the cornea; it therefore follows as a general rule, that there is less danger in entering too far from, than too near to the ciliary bodies.

The object in view in turning the back of the needle forwards while it passes under and before the cataract, and thence into the anterior chamber through the pupil, is to preserve the retina and iris as much as possible from the action of its point or edges. It is passed into the anterior chamber, that it may give assurance that it is not entangled between the capsule and lens. The tearing of the capsule is more delicate and more important than generally imagined. It should be begun at the circumference. If it be commenced at the centre, it will afterwards be very difficult to detach the shreds and prevent a secondary cataract. The best plan is certainly to depress both the lens and its capsule together, without any laceration, as some authors have recommended; but how are we to get a membrane so thin to the bottom of the eye without dividing it, however slight its adhesions?

To depress the opaque body, it is not sufficient barely to seize it with the point of the needle. The concavity of the instrument must exactly embrace it; otherwise it will become reversed with the least pressure, either upwards or downwards. The depression once commenced, the needle becomes a lever of the first kind, its fulcrum being the opening in the sclerotica; to continue its action outwards, backwards, and downwards, it is necessary that the convex side of the point of the instrument should be gradually turned upwards, at the same time that we are performing the other movements before mentioned.

When the cataract is depressed, some recommend the patient to turn his eye upwards and inwards, believing thereby, but erroneously, that the lens will be sunk deeper. By not withdrawing the needle for some seconds, the compressed cells of the vitreous humor are allowed to take their natural position

and imprison, as it were, the cataract, which would almost necessarily return if it were left immediately. The slight rotatory movements that are given to the instrument before withdrawing it, are intended to detach it with the slightest possible disturbance of the lens, so as the more surely to leave that body in its new situation.

If, in spite of all these precautions, the cataract rises again, it is necessary to seize it anew, and to depress it more deeply; continuing to do so until it rises no more. If it be soft the instrument bursts it, and then it is but rare that the whole is depressed below the pupil. In that case, if it be impossible to carry the pieces backwards, the operator should endeavor to reduce it to small morsels, and then force it into the anterior chamber, to be dissolved by the aqueous humor and absorbed. Any opaque mass that may remain after a depression of the lens, should also be carried there. This is easily done with such portions as are completely free. This unhappily is not the case, however, when we have to do with pieces of the capsule of the lens. Then practice and address are requisite to pierce them, near the centre of their base, with the point of the needle, and tear them, by rolling them on themselves or by dragging them away. It is important to leave none such in the visual axis, for their opacity will necessarily compromise more or less the success of the operation. If the capsule adhere to the iris, it must first be separated, taking as much care as possible of the iris. If any circumstance prevents this disjunction, we are reduced to the necessity of displacing the lens first, and then to operate upon this portion of the capsule, as above directed.

If the cataract be milky, and the capsule be affected, as is almost always the case, it is indispensable to carry the instrument to the centre of the pupil before dividing any thing. Otherwise, the opaque liquid escaping into the eye, clouds the humors and prevents the operator from seeing what he is doing. Yet, if this inconvenience should occur, whether the needle were or were not in the anterior chamber, he should simulate as exactly and with as much prudence as possible the movements necessary to tear away all that may require removal.

b. Process of Petit and Ferrein.—At the beginning of the last century some authors maintained, against Hecquet, de la Hire, &c., that the seat of the cataract is always in the chrystalline lens, and not in its membrane. Petit, the physician, adopting this hypothesis, thought of depressing the opaque body without touching the anterior leaf of the capsule. After thrusting the needle into the posterior chamber to attain his object, Petit inclined one edge outwards and backwards, by which means he opened the vitreous body, and then carried it to the external, inferior, and posterior part of the capsule, which he tore; then grappled the lens and conducted it into the hyaloid body, conforming otherwise to the general rules of depression.

This modification, which was revived some years after by Ferrein, who claimed the honor of its invention, was afterwards defended by Henkel, Gunz, Gentil, Walborn, &c. By leaving the anterior capsule untouched, they expected to establish sight more perfectly than by the common method. It was thought that by falling upon a convex membrane, the luminous rays would scarcely perceive the absence of the lens; that the accordance of the focus of vision would be maintained, and that there would be no need of glasses after the operation. To these reasons it was objected, that the capsule

itself was often the seat of the affection, either alone or conjointly with the lens; that still more frequently it would become opaque after the operation, and produce a secondary membranous cataract; and, consequently, so far from attempting to save it, it should be as completely destroyed as possible; and, finally, that by depositing it in the vitreous humor, instead of depressing it, the patient is exposed to serious accidents.

c. Process of the Author.—The last objection adduced by the adversaries of Petit is the only one destitute of foundation. If the rupture of the vitreous body be dangerous, the operation by depression could scarcely ever succeed, for it is almost impossible to prevent this effect. If the lens be not drawn in some manner, in spite of the operator, into the vitreous body, how would it ever remain depressed, repulsed, as it would be continually by the natural elasticity of the hyaloid membrane? Besides, in passing it between the shell and the humors of the eye, how can it be prevented from tearing the retina, and making a havoc an hundred times worse than the incision of the vitreous humor? Starting from this idea, M. Bretonneau has adopted the method of Petit, with a slight modification; that is, after forming a passage for the lens in the vitreous humor, he tears it away from before as in the ordinary process. Having witnessed the success of this method in the hospital of Tours, in 1818 and 1819, I have since used it on all occasions, and have never had cause of regret. I perform it in the following manner: the needle is directed as if to pass behind the cataract; when it has penetrated about four lines deep before changing the position, it is to be inclined downwards, backwards, and outwards, in order to open largely the hyaloid mass; the back is then turned to the iris, and by elevating the handle, the point is made to pass under the inferior edge of the lens, to be afterwards brought into the pupil; the anterior leaf of the capsule is then torn up, the opaque body seized and pushed with a regular swaying motion in the direction of a line from the great angle of the eye to the mastoid apophysis on the same side. By this means we escape wounding the iris; the elasticity of the vitreous body, which is sometimes very great, cannot offer the least resistance, and the cells of the membrane immediately closing the passage, oppose successfully the reascension of the opaque body.

Hyalonyxis.—An itinerant oculist, Mr. Bowen, has published a pamphlet in which he brings forward a method which he calls hyalonyxis, and which he thinks preferable to all others. His aim is to traverse the vitreous body from behind forwards, and downwards; then open the posterior leaf of the capsule and displace the lens, after the manner of Petit and Ferrein, without touching the anterior portion of the envelope. To accomplish this, Mr. Bowen pierces the sclerotica at four lines from the cornea; then pushes the needle towards the cataract, behind which he stops; breaks open the capsule, without going as far as the pupil; seizes the opaque body and buries it among the cells of the hyaloid sac, using the instrument throughout as a crotchet or lever. The results, according to the book, are highly favorable to hyalonyxis, scarcely averaging two failures in twenty cases. From it we may, at least, conclude that there is little danger in wounding the retina and vitreous body. For the rest, I see no advantage in going so far from the cornea, nor need I reiterate the inconveniences of leaving undestroyed the anterior support of the lens. Besides, nothing prevents us from preserving it by the method I have already indicated.

Scleroticotomy.—Some years ago, I scarcely know why, M. Gensoul introduced a strange operation, which he soon after abandoned, but which M. Roux has thought proper to attempt at *La Charite*, in Paris. The original idea belongs, I think, to B. Bell. A small incision is first made behind the iris, at the junction of the sclerotica with the cornea; through it the surgeon introduces a kind of curette before the lens, depresses that body, and the operation is finished. The only advantage of so large an opening of the sclerotica, would be in remedying more easily than by a simple puncture a too great fullness of the eye. But the division of the ciliary body, the possible escape of the humors, and the impossibility of carrying the cataract far enough back, are sufficient *a priori* to make us reject it, if even the attempts of its inventor, and of M. Roux, had not shown its inconveniences and dangers.

f. Retroversion or Reclination.—After Pott, some English and German operators, Willburg and Schifferli among others, have advanced the idea, that instead of depressing the lens it would be better to turn it over. It cannot be denied that this modification renders the manual part of the treatment more simple and easy. After the anterior capsule has been torn, it is sufficient to apply the needle a little nearer the upper than the lower edge of the lens. Then, by pressing upon it, the lens is instantly turned upon its transverse axis, its anterior face being upwards, and its superior edge behind. But if the opaque body is to be carried, besides, into or under the vitreous humor, as recommended by Beer, Weller, &c., this operation is then evidently changed into the ordinary one; whilst, if it be left below the centre of the pupil, in the posterior aqueous chamber, it is clear that in most cases it will either rise again, or produce such irritation of the iris and the rest of the eye, as to occasion the most serious consequences.

g. Cutting or Breaking up of the Lens.—After demonstrating that when once in contact with the aqueous humor, the lens is dissolved and finally disappears, Pott wished also to prove that it is not indispensable to depress it below the visual axis, but that, as Warner had advanced, to reduce it to fragments, or even to open the capsule, was sufficient to destroy the disease. Experience has often confirmed this idea; for the examples of dissolution and absorption of a whole or a divided lens are not rare. As this method removes the most delicate portion of the ordinary operation, it is not strange that many oculists have adopted the opinions of Mr. Adams, who recommends it in all cases. Yet I would say the same of it as of retroversion. It may be used when the cataract is soft or too difficult to displace, but, in spite of the eulogies of M. Parmi, it is less certain than depression, properly so called. If it be true that the fragments of the lens sometimes dissolve very rapidly, it is equally true that they often persist for many months, and even indefinitely, thereby preventing the restoration of sight. If there then be less injury done the vitreous humor, it is less easy to escape injuring the iris. Supposing there are some advantages in leaving the cataract to be slowly dissolved, they are counterbalanced by the inquietude of the patient, and the loss of time between the operation and the restoration of vision.

To execute this operation any needle will serve; but that of Beer, or the small needle of M. Lusardi, in the form of a pruning hook, seems better than that of Hey, Dupuytren, or even of Scarpa or Bretonneau. Although the lens may be broken up from its posterior face, it is as well to prefer the anterior,

that we may more surely see what we do, and more certainly avoid the iris. In this direction, when the instrument reaches the pupil, and when the capsule is sufficiently torn, the lens is cut into two parts by the point and edge of the instrument, and these again divided into as small fragments as possible, the largest of which we endeavor to push into the anterior chamber. When the operation is performed through the posterior face of the capsule, and with a straight needle, the breaking up is really more easy, because the anterior lamina of the capsule remains entire, and because the lens, enclosed as it were in a sac, is unable to escape the action of the instrument; but the vitreous humor suffers much more than by the other process; and, besides, it is not uncommon to pierce, at the first motion, through and through the lens and its envelope.

h. The Lens passed into the Anterior Chamber.—At the moment of the operation the lens may slip through the pupil into the anterior chamber, in consequence of some movement of the operator or the patient. It also sometimes gets there in consequence of a blow, a fall, jolt, or any thing that can jar the head, or produce in any way the rupture of the capsule. This accident does not, however, oblige us absolutely to operate by extraction, as some have thought, to remove the displaced disc. As it passed the pupil to get into its new position, it certainly may be made to repass it into the old one; and it would always be more agreeable, to both operator and patient, to finish the operation whilst the needle is in the eye, than to withdraw, and complete the operation by incision of the cornea. In cases where nothing has been attempted before the accident, it is no obstacle to depression, if the pupil remain dilatable, and there be very little inflammation. M. Dupuytren and Lusardi have used the ordinary needle in such cases, passing it through the sclerotica and pupil into the anterior chamber, securing the lens, opaque or not, and then returning with it into the posterior chamber.

i. Ceratonyxis.—Depression, retroversion, and breaking up of the lens, which are commonly performed by *scleroticonyxis*, or sclerotico-hyalonyxis, are also sometimes done by ceratonyxis; that is, by penetrating through the transparent cornea. This method, which many moderns claim the honor of inventing, is far from being new. Avicenna speaks of some operators who first opened the cornea, penetrating from thence to the lens, which they then depressed by means of a needle which they called *al-mokadachet*. Abul-Kasem says, positively, that he had followed this method. Manget also gives the history of an English woman who cured the cataract by piercing the cornea. In Haller's collection a thesis is found, defended by Col. de Villars, in which this mode of operating is much extolled. It is thus, says the author, that birds recover their sight, by sinking a thorn into the eye; and, according to Galen, a goat pointed out to man the method by which he should operate for cataract. In the eighteenth century Smith revived the operation of the Arabians. Derdell, the disciple of Woolhouse, imagining that the cataract was almost always membranous, recommended to pass through the cornea to the anterior lamina of the capsule, and to remove thence a circular disc, leaving a sort of window for the passage of the light. Taylor and Richter have frequently performed ceratonyxis in cases of milky cataract. Gleize, in France, and Conradi, in Germany, spoke of it in 1786. In 1785 Beer had tried it twenty-nine times. M. Demours had recourse to it in 1803; the epoch at which

Reil called public attention to it, and gave it the name it now bears. But the united efforts of Buchorn, from 1806 to 1811; of Langenbeck, from 1811 to 1815; of Dupuytren, Guille, and Walther, in 1812; Wernecke, in 1823; Textor and Pergin, in 1825, were necessary to give it a place among the regular operations.

The patient and assistants are placed as if for scleroticonyxis. A needle, such as Bretonneau's, for example, or Langenbeck's, which is sharper and with less extent of cutting edge, is presented at about one line from the sclerotica, and, supported by the back of the finger that depresses the lower lid, sunk into the anterior chamber through the inferior and external part of the cornea, reaches the pupil. The operator now turns the concavity of the instrument downwards, having until then held it in the opposite direction to escape the anterior face of the iris; opens the capsule freely, detaches the lens, catches its superior edge, and pushes it down and turns it backwards, and endeavors to sink it below the pupil into the vitreous humor, or what is better, breaks it up, and depresses the principal fragments when they cannot be drawn into the anterior chamber. He then turns the back of the needle again downwards, and withdraws it in the same manner that it was introduced.

Remarks.—Ceratonyxis must not be attempted until the pupil has been made to dilate as much as possible; and even then it is very difficult to avoid pulling its borders while we seek to depress the lens. It is to escape this inconvenience, and especially that of pricking the iris, that amongst us the straight needle has been proscribed, and that we penetrate at some distance from the sclerotica, taking care not to go too near the centre of the cornea. Neither the pyramidal needle of Beer, the shoulder which Græfe has added to the ordinary needle to prevent its penetrating too far, nor the needle of Himly, Schmidt, &c., offers, in reality, any advantage over those commonly used in France, nor merits further notice. In animals this method is preferable to all others, for reasons that need not be pointed out. Although in the human species it may, strictly speaking, be employed whenever depression would be proper, yet it should be chosen only for the milky cataract with children; with intractable persons, when the eyes are very movable, irritable, or deeply sunk. The same hand may be used on both eyes. There is no risk of dividing nerve or vessel. The retina is untouched. The iris is not more endangered than by the posterior method. The tissues traversed have little sensibility, and the membrane of the aqueous humor that Wardrop, Langenbeck, and Chelius appeared to fear so much to wound, enjoys but a very feeble vitality. The operation is therefore but a simple puncture, and may be repeated a certain number of times without serious inconvenience. But to these advantages may be opposed defects not less numerous. Adhesion of the capsule, contraction of the pupil, flatness of the cornea, projection of the iris, hard, chalky, or stony cataract, seem all unsuited to its application. Properly it is only for breaking up or retroversion of the lens, that this method should be used. Although it has succeeded seven times in eight in the hands of M. Textor; although it has failed but twenty-six times in three hundred and forty five cases with M. Walther; once in six times with M. Dupuytren, and four times in one hundred and twelve cases with M. Langenbeck, still it has been abandoned as a general method even by its warmest partisans. It is, in fact, incapable of replacing scleroticonyxis, which alone

permits us to carry the lens, without extraction, out of the visual axis and permanently to fix it there; therefore this method can only be considered one of exception.

j. As to the simple *puncture of the cornea,* formerly performed by Lehoe, and more recently by Wernecke, for the purpose of favoring the absorption or dissolution of the cataract, there is not enough proved in its favor to entitle it to be formally recommended. Nevertheless, if, as cannot be doubted, the decomposition of the lens, separated from its capsule, is a phenomenon much more chemical than vital, we cannot see why the evacuation of the aqueous humor, saturated with the anomalous substance, would not favor the disappearance of the cataract by permitting the solvent to be renewed. Such a practice seems to me applicable only to the consequences of ceratonyxis and breaking up of the cataract; that is, when a greater or less portion of the opaque body remains out of the posterior chamber without disappearing.

k. In Children.—In early age we can scarcely think of operating by extraction. Then the evacuation of the eye could scarcely be prevented, as has been proved by Scarpa, Ware, Saunders, Gibson, M. Lusardi, &c. Both congenital and accidental cataracts in young subjects are almost always liquid and membranous. Consequently there is nothing to depress or to extract. The object to be accomplished is to lacerate the anterior leaf of the capsule as completely as possible, and to evacuate it of the matter it encloses. It is then almost immaterial whether we operate by ceratonyxis or scleroticonyxis, at least when the pupil is large, as it commonly is in such patients.

The most difficult matter is to hold the patients. Ware laid them upon a table, their heads elevated with pillows; held them in that position by the aid of assistants, and fixed the eye with the fingers, whilst another person elevated the upper lid by means of Pellier's elevator. Gibson gives first an opiate; then secures the refractory in a sort of sack open at both ends, which is closed by draw-strings above the shoulders and below the feet. M. Lusardi finds it more convenient to set them upon the angle of a table, after having secured the arms around the body; placing their legs between the thighs of the operator. The head and the rest of the body is held by assistants. Then with one hand, furnished with a speculum which he calls contentive, M. Lusardi fixes the eye and holds apart the lids, whilst he uses the needle with the other.

Whether we penetrate through the cornea or sclerotica, it is always necessary to produce a true loss of substance in the anterior lamina of the capsule, and not a mere rent, if we would avoid the risk of soon seeing a secondary cataract. If the lens possesses much consistence, or if it appears necessary to tear up the capsule, we must, as for the adult, sink the fragments into the vitreous humor or carry them into the anterior chamber, where absorption operates more promptly than behind the iris. At the end of fifteen or twenty days, if there remain any opaque portions at the place of the lens, Ware recommends us to repeat the operation. He is said to have practised four or five times upon the same child with ultimate success. Such a plan should be followed, if the operator is convinced that the fragments of the cataract cease to diminish. Perhaps this would be a proper case to try Wernecke's method of evacuating the aqueous humor by means of a puncture of the cornea.

When instead of the left eye, as I have heretofore supposed, we operate on the right, the left hand should be used, unless it be in ceratonyxis, where,

as we have seen, this precept is not necessary. If both eyes be affected, as soon as the operation is finished on the first, it is to be covered with the bandage which till now has covered the other, and that is immediately to be treated in the same way as the first.

Consecutive Treatment.—When all is finished, the patient is desired to hold the lids lightly closed. The practice of presenting some object to be assured of the result of the operation should be abandoned. By suddenly reaching the bottom of the eye, the light irritates the retina too much, and the proof is only necessary to satisfy a vain curiosity. Especially when the needle is employed it entirely fails of its object, for the disturbance which has just been produced in the ocular chambers will render sight at first very confused, although it may subsequently become very good. No one at the present day would think of following Purman's advice of applying a small piece of gold-leaf upon the puncture of the sclerotica, with the intention of preventing the escape of the aqueous or vitreous humor. Brandy and the white of an egg, employed by the ancients, and a thousand other topical applications, extolled without cause, are equally rejected. It is sufficient to dry the lids with a sponge or a fine compress, and then place over the eye an oval piece of linen cut in holes, dry or covered with cerate, and over that a soft fold of lint, a bandage with a T incision for the nose, and secured behind with pins to the cap; and finally, the taffetta bandage, which covers the whole. It is important that none of these pieces should be so tight as to compress the contents of the orbit. It would even be better, perhaps, to imitate Ware, who applied a simple piece of linen to the eye, and proscribe, as some others do, every thing that could embarrass the head. In no case must the subject be allowed to make any effort or movement. He is to be carried to bed, and laid upon his back, his shoulders and head raised with pillows. He is to be surrounded by dark thick curtains so as to prevent the ingress of light, and recommended to the most perfect repose of mind and body. He must be allowed only light soups for three or four days. If the bowels be not regular, glysters, or even laxatives, should be given. He may be allowed relaxing drinks, such as whey, barley-water, veal soup, decoction of tamarinds, and the like. Bleeding must be used upon the occurrence of fever, or when pain in the head indicates it. When nausea or vomiting comes on, laudanum in the dose of a demigros in an injection, as recommended by Scarpa, produces a happy effect. In ordinary cases the infusion of linden, violet, or poppy, sweetened with syrup, are the drinks commonly used. Insomnia and nervous agitation are combated by an ounce of syrup of poppies in a julep. When no serious consequences have followed the operation, the eyes may be uncovered on the fourth day. The patient begins by sitting up. The linens being removed, the lids are moistened and cleansed by the patient himself, with a piece of sponge and warm water. As soon as they are dried the patient may open his eyes, the curtains being carefully closed at the same moment. When the pupil shows well, it is not prudent at that time to inquire further into the restoration of sight; the dressing is to be renewed each day in the same way as for simple ophthalmia, as long as the eye continues red. If every thing goes on well, a little more light every day is admitted to the eye, so that at the end of from twelve to twenty days they may be uncovered entirely, except a shade of colored taffeta. The diet need not then continue so strict, and in the course of the

second week the patient may be allowed by degrees to resume his usual regimen. If it be otherwise, it is necessary to attend to the symptoms which present themselves; using appropriately either bleeding, local or general, purgatives, revulsives, or such collyria as would be suited to the same kind of disease produced from any other cause.

B.—*Extraction.*

Cataract was as yet but imperfectly known, as to its nature or situation, when its removal was first undertaken. Antylus, according to Sprengel, opened the cornea, and seized the opaque pellicle through the pupil, in order to extract it by means of a needle. Lathyrus operated in the same manner. Ali-Abbas and Avicenna speak of extraction as a customary method. Abul Kasem says he learned of an inhabitant of Irack, that in that country they introduced into the anterior chamber a short needle, which served to pump the cataract. Avenzoar and Iza-Ebn-Ali, who rejected it, assert that in their time extraction was customary in Persia. G. de Chauliac himself has not forgotten it, and Galeatius, the commentator on Rhazes, who extols it highly, represents himself as the inventor. Completely unknown to, or abandoned by the authors of the middle ages, this method of operating seems not to have been restored to practice until towards the close of the seventeenth or commencement of the eighteenth century. In 1694, Freytag opened the cornea after the manner of the Arabians, and then drew from the eye an opaque membrane, which was doubtless the anterior leaf of the capsule of the lens. Woolhouse passed the anterior chamber with a needle so constructed as to be susceptible of transformation at pleasure into forceps, which served him for seizing the opaque body and abstracting it. Petit, performing in the presence of Mery the extraction of a cataract which had fallen into the anterior chamber, surprised his assistants by showing them an opaque lens instead of the pellicle they expected to see. Saint Yves attempted to extract the lens, but without success, which induced him, we cannot see why, to maintain more strongly than ever that the cataract has not its seat in the body of the lens.

Yet these various attempts had scarcely fixed public attention, when Daviel, in 1748, submitted his new method to the judgment of the academy, endeavoring to prove that extraction is infinitely preferable to depression. With a broad flexible lance-shaped needle he opened the inferior part of the cornea, and then enlarged the opening by means of another needle, smaller than the first, cutting on both sides, or with a pair of small curved scissors. A spatula of gold to separate the lips of the incision, a needle of the same metal to open the capsule, a curette to favor the escape of the lens or its integuments, were also necessary. The lens having fallen into the anterior chamber, he was obliged to put his plan in use for the first time, in 1745; after that he entirely renounced depression. One hundred and eighty-two successful cases out of two hundred and six operations announced to the academy, made a lively impression there, as well as upon the public generally; and although Caque, of Rheims, could report but seventeen completely successful cases out of thirty-four operations, each of them was eager to repeat his attempts.

Pallucci, who pretended, in 1752, to have practised extraction before Daviel,

opened the cornea from the less to the greater angle with a knife, the point of which, being considerably elongated, resembled a sort of needle. Poyet invented a narrow instrument, pierced near the point so as, in traversing the eye, to pass a thread suited to sustain this organ while he completed the flap of the cornea. La Faye proposed to supersede all the instruments of Daviel by a knife in the form of a lancet, a little straightened, slightly swelled on one of its faces, the back dull almost to the point; he added a cystitome—a kind of triangular pike supported by a spring, and inclosed in a sheath swelled in the middle so as to resemble the body of a syringe. Soon after Berenger modified the ceratotome of La Faye, giving it greater breadth; he made one side plane, the other convex and much thicker towards its back. Siegerist gave still greater length to the point of the knife of Pallucci, in order to open the capsule whilst crossing the anterior chamber. But Jung has well remarked, that a cataract needle is the best cystitome. At this juncture in the state of the professional mind upon the subject, appeared Richter, in Germany; Wenzel, in France; and Ware, in England; who have decisively established the rules for extraction.

Operation.—Two methods have been proposed for extracting cataract. One, little known in France, is called scleroticotomy; the other, almost the only one used, is called ceratotomy. The same preparations are applicable to both. The dressings are similar to those necessary for depression. Nevertheless, the position of the patient, the assistants, and the operator require precautions a little more minute than in the latter method. It is for extraction especially that Richter and Beer insist upon the necessity of a solid and vertical back to the seat, against which it will always be more easy, they say, to maintain immovably the head of the patient, than against the breast of an assistant. The horizontal position, proposed by some one, boasted of by Rowley and Pamard, and which appears to offer, in fact, some advantages, by rendering it less easy for the humors to escape at the moment of the operation, is, however, but rarely preferred; no doubt because it is somewhat embarrassing to the surgeon. I have tried it twenty-five times, and I must confess I have not been able to comprehend why it has not been more frequently used. In operating in this way it is necessary for the surgeon to place himself on the side of the affected eye. But if the patient is to be seated, it is then, if not indispensable, at least more convenient for the surgeon to operate standing up before him than seated.

The speculum invented by F. de Aquapendente, afterwards used by Sharp, modified by Heister, De Witt, &c.; the ring of Bell and Assalini, which M. Lusardi has mounted on a handle and reproduced under a new form; the elevators of Sommer, and all other instruments invented to separate, raise, or depress the eyelids—useful if we have not sufficiently adroit assistants—are advantageously superseded by the fingers. Almost all are liable to compress and empty the eye. The same may be said of the ophthalmostats, amongst which may be distinguished the forceps of Ten-Haaf; the pike of Pamard, which latter Casamata curved into the form of an S, that it might better accommodate itself to the nose—which Rumpelt fixed upon a thimble, that he might use it with the middle, whilst the index finger of the same hand pressed down the inferior eye-lid, and which Demours wished still further to modify by mounting it on a thimble open at both ends. Yet I do not know that the trefoil of

M. Pamard, such as the grandson of the inventor represented it to us, in 1825, really merits the reproaches that have been cast upon it. Its point, a line and a quarter long, is limited by a transverse shoulder-piece. Curved in such a manner as to be applied without pain to the nose, its shank is mounted upon a handle, which is seized in the same manner as a pen in writing, so as to force with one hand the point into the cornea, one line from the sclerotica, at the same time that with the other we carry the knife to a point diametrically opposite, at one half of a line only from the circle of the iris. The inventor intended, very correctly, that these two instruments should be applied and withdrawn together. In this manner we could operate with the same hand on both sides, and I can conceive that a great deal of practice, and a perfect accordance in the action of the trefoil and the ceratotome, could render such an instrument much more useful than is generally imagined. I find it less dangerous, for example, than the two fingers of the assistant and the operator placed at the larger angle of the eye, as directed by Ware, to prevent it from rolling inwards, and to compress it until the moment the knife finishes the flap of the cornea.

1st. *Scleroticotomy.*—After experiments on the dead body, B. Bell asserted that it was possible to extract the cataract by the sclerotica as well as through the cornea. This idea, which Earl was the first to practise on the living subject, being revived by L. Lebel, has been definitely adopted by M. Quadri, of Naples, who founds upon it his new method—*scleroticotomy.* An incision three lines long is first made with any ceratotome whatever upon the sclerotica, two lines from the cornea. The lens and its envelope are then seized by means of a small pair of forceps, and the whole removed by the external angle of the eye. Pursuing this plan, M. Quadri affirms he has had but four unsuccessful cases out of twenty-five operations. The first step of this is less delicate, and perhaps less exposed to immediate accidents, than the same in the ordinary methods. It cannot be very difficult to seize the cataract; but how is it to be held so surely as to make it pass through the opening without great danger of emptying the eye? How can we believe that so large an incision of the three principal tunics of the eye will not be most frequently accompanied by internal hemorrhage, by wounds of ciliary nerves or vessels, and be followed by consequences much more serious than those which succeed the opening of the transparent cornea?

2d. *Ceratotomy.*—Extraction, properly so called, is divided into three principal steps: the incision of the cornea, the opening of the capsule, and the expulsion or extraction of the lens. The instruments used for effecting it have been greatly varied, and are as yet far from being the same in the hands of all operators. In France the knife of Wenzel is in common use; it differs from that of La Faye only in having its faces alike and perfectly plain. Some operators, however, prefer the ceratotome of Richter, the blade of which, being very sharp, enlarges gradually from the point to the handle, so that it can cut or divide one half of the circumference of the cornea, whilst crossing the anterior chamber. That of A. Pamard resembles the half of a myrtle leaf, and has on its superior edge, which is straight and dull, a small rib to augment its strength. The knife of Ware, generally used in England, is almost similar to that of Richter, and the instrument of Beer, so much boasted of in Germany, differs from it only in the greater breadth of its point and some-

what less length of blade, which is also a little broader. Berenger has proposed an instrument, convex on one side, plane on the other, and a little wider than that of La Faye. Lobstein widened it still more, and lengthened the point. With this form, its convex face turned behind protects the iris, whilst its plane face glides very easily behind the cornea. Slightly modified by B. Bell, this knife has since been improved by Jung, one of the ablest cotemporaries of Beer. According to Sprengel, the ceratotome of Jung, convex on both faces and cutting with both edges, is very short, and a little broader than is necessary to divide at one cut the semicircle of the cornea. On the contrary, according to M. Harel, it should be, like that of Lobstein, convex only on its posterior face, and resembling a sort of guillotine. Finally, that of Barth is distinguished from the preceding by the furrow which it presents near the back, on one of its faces.

In the midst of such abundance, the most important matter is the selection of an instrument of such form and dimensions as will permit the complete division of one half of the cornea, whilst traversing in a direct line the anterior chamber, and without permitting the escape of the aqueous humor before the completion of the incision. To accomplish this object, its blade must be of a triangular form, one inch long, three lines wide at the heel, slightly convex on both sides, a little stronger towards its back than towards its edge, and becoming thicker by degrees from the point to the handle. Accordingly, the knife of Richter, a little shortened, as Beer recommended, appears to me preferable to all others; to that of Wenzel in particular, and even that of Lobstein, as modified by Jung. Yet it is evident, that in a case of absolute necessity, we might accomplish our purpose with a simple lancet, the little hooked knife of Sharp, a sharp bistoury, or, in fine, with an instrument of almost any kind. We therefore speak of what is most convenient, not of what is absolutely necessary.

The second step in the operation has also given much exercise to the industry of surgeons. The needle of Thuraud, the lancet of Tenon, that of Hellman, Durand, and Grandjean, the stylet of Mursinua, the cystitome of La Faye himself, with or without the modifications of Rey, are generally abandoned. The hook of Boyer would have fallen into equal desuetude, if the curette of Daviel, which is yet sometimes used, were not mounted with it on the same handle. The new cystitome proposed by M. Bancal, founded on the same principles as that of La Faye, from which it differs, however, in the flattened form of its body, and in incising the capsule from the greater towards the smaller angle, in a semilunar direction, and not by a simple puncture, will probably share the same fate. The reasons urged in its favor do not prevent the substitution of the point of a ceratotome, or a common needle. A straight and delicate forceps, carrying a hook at the end, like that of Reisenger; the straight forceps of Blemer; or the toothed forceps of Beer—such ocular forceps, in fine, as may be found at any cutler's—a crooked needle, a small spatula or curette of gold, and the syringe of Anel, which may be useful for detaching or bringing away some of the shreds of the capsule or pieces of the lens, after the extraction—may also be placed with the knife and the needle beside the operator.

a. Inferior Keratotomy.—First Step.—The patient and the assistants being placed as for depression, the surgeon draws down the inferior eye-lid with the

index finger, which he applies at the same time upon the caruncula lachrymalis, in order to sustain the globe of the eye on the inside; then seizing the cataract knife with the other hand, and placing the point at a half line or a line from the sclerotica, and resting the end of the little finger on the temple, he pushes the knife without hesitancy into the anterior chamber, perpendicularly to the axis of the cornea, a little above its transverse diameter, and from the side of the external angle of the eye. Immediately after, he inclines the handle of the knife backwards, without which precaution the point could not fail to wound the iris, and pushing it horizontally, with firmness, to the point of the cornea directly opposite, until it pierces it again from within outwards, urges it forward in this same line without pressing upon its cutting edge; taking care never to turn it outwards, but keep one of its faces exactly parallel with the anterior face of the iris, whilst the other looks towards the front of the eye, until, by the continuance of its progress, it has entirely divided the inferior half circle of the cornea as near as possible to the sclerotica; that is to say, at a line, or a half line from the great circumference of the iris. At the moment the knife terminates the section, the least pressure would be extremely dangerous, requiring, consequently, the greatest caution to avoid it. At that instant the assistant must let go the eye-lid, which the patient, to whom are accorded some seconds to recover his self-possession, closes gently.

Second Step.—After having gently wiped the region of the eye, the surgeon, or the assistant, raises a second time the upper eye-lid, taking great care not to touch the globe of the eye, and presenting, with the other hand, the back of the cystitome of Boyer, or a cataract needle, at the lowest point of the incision, he penetrates from thence through the pupil at its upper part, and carries the instrument from one side to the other in such a manner as to divide the envelope of the chrystalline freely with the point of the instrument, the concavity of which should be kept downwards. When both eyes are to be operated on, we stop here on the first until we have opened the cornea and capsule of the second.

Third Step.—If the cataract do not of itself appear in the anterior chamber, we determine its escape by gentle and well directed pressure. The operator applies the index finger of the left hand against the inferior part of the eye; with the right he places the handle of a ceratotome, or the back of Daviel's curette, on and across the superior eyelid, so as to execute with gentle pressure some slight movements to and fro over the ciliary circle, in the direction of a line from that point towards the union of the anterior two-thirds with the posterior inferior third of the sclerotica, passing downwards between the lens and the vitreous humor. We soon see the lens passing out at the pupil and presenting itself by its edge at the incision in the cornea, which it clears, or which we cause it to clear by gentle pressure from above. It is taken away with a curette, needle, or the point of a knife, and the operation is ordinarily finished. If any opaque shreds of the capsule, so large as to affect the success of the operation, can be seen, they are to be seized and extracted by the forceps. All other fragments may be taken away in the same manner, if the spatula or the curette be insufficient. As to those which fall into the anterior chamber, at least such as are not too large, it would be better to leave them to the solvent action of the humors than to rub the posterior surface of

the cornea so often as would be necessary to take them away by the little spoon of Daviel. The same may be said of the diffluent lamina which so often detaches itself from the lens while it escapes from the anterior chamber, and remains arrested about the incision in the cornea. Whether the contact of the instrument with the membrane of the aqueous humor inflames this lamella, as has been asserted by Sommer, or whether it may be injurious in some other manner, certain it is, that such a proceeding is frequently followed by an immediate and complete opacity of the anterior portion of the eye.

Remarks.—Instead of commencing the incision just at the extremity, or a little above the transverse diameter of the eye, Wenzel prefers entering the knife at the middle of the superior and external quarter of the cornea, making it to pass out by the corresponding point in the inferior and internal quarter. His reason is, that in this way the greater angle and the root of the nose run less risk of being wounded, and that, as the flap is oblique, the eye-lids are forced, in closing, to compress its two extremities, thereby preventing either of them from becoming engaged in its lips. This precept is generally admitted in France, but is far from having fixed, in the same degree, the attention of other nations. In Germany, for example, it is so little known, that Weller, who advises it, seems to wish to appropriate it to himself. We should not be wrong, perhaps, to follow it where the eye is very large or projecting, because with such a conformation the inferior palpebral border would have a strong tendency constantly to separate the lips of the incision; but otherwise, the advantages which have been attributed to it have been deduced, assuredly, much more from theoretical reasoning than from practical experience. By cutting at less than half a line from the circumference of the cornea, it is difficult to avoid the iris; and we should have cause to fear that the opacity of the cicatrix would reach too near the centre of the pupil. A step which the student finds most difficult to execute well, is the striking perpendicularly on the eye. It is, however, a point of the greatest importance. In approaching too near to the transverse line, the point of the knife becomes almost always engaged between the different laminæ of the cornea, gets more or less obliquely through its thickness, and arrives at last in the anterior chamber, but at a line and a half from its entrance; giving, in fact, a very little opening, although in appearance the wound is very large. To accomplish the object properly, it is necessary that the surgeon should never lose sight of the position of the eye, and according as this organ is more or less turned inwards must his instrument be more or less inclined towards the temple or towards the face. It must be recollected, at the same time, that the cornea is the segment of a smaller sphere than the sclerotica, which occasions the perpendicular at the point of puncture to be a little less inclined towards the median line. As the knife is entering the anterior chamber, the cutting edge must be kept as exactly downwards as possible, in order to escape the ciliary circle and iris behind, or making a cicatrix too near the centre, if it were inclined forwards. At the moment the point is about to pass the side next the caruncula lachrymalis, if it be not directed a little anteriorly, it will carry itself towards the sclerotica and dig into the cornea. When the operator commences pushing his knife, he must continue it without ceasing, making no retrograde movement until he has completely traversed the front of the eye. The gradual increase of the thickness and breadth of the knife permits it to

fill the incision exactly, so that the aqueous humor cannot escape until the incision is completed. But if the knife be drawn backwards in the least, it necessarily leaves a passage for the immediate escape of this liquid. Then, the iris floating forwards, and the anterior tunics of the eye becoming flaccid, the incision can only be terminated with the scissors, unless it is preferred to postpone the operation to another time. The rule requires that at least one half of the circle of the cornea should be detached. A smaller flap would render the escape of the chrystalline difficult, especially when it is voluminous, and would require pressure that might be followed by the expulsion of the vitreous humor. Ware extended it to two-thirds of this membrane, but although in such a case gangrene of the flap, dreaded by M. Maunoir, be not much to be feared, yet it is not necessary to go so far.

In proscribing without distinction all instruments for holding the eye, surgeons have not thought it the less necessary to prevent all movements of the eye whilst traversing the anterior chamber. When it turns itself obstinately towards the vault of the orbit, the trefoil of Pamard is the only thing that can render extraction practicable. If it be towards the greater angle that it conceals itself, in case the will of the patient should be insufficient to direct it out, we can sometimes accomplish it by the aid of the finger, applied over the caruncula lachrymalis. The eye might be fixed without pain, and even without danger, between the middle and index fingers of the operator and the assistant, if the operator were assured of the cessation of all pressure after the knife has traversed the cornea from side to side, that is, just before the definite completion of the flap; but it is so easy to evacuate the eye of the living subject, that without great practical experience it would be imprudent to adopt this practice. Yet I see no risk in proceeding thus until the knife reaches the greater angle. Then the operator is master of the organ. Nothing prevents the completion of the operation, provided the blade of the instrument be not displaced. Instead of the flexible probe, used by Pellier, Siegerist, &c., the surgeon, when the ball of the finger is insufficient to attain the end, may use the nail of the index, or even of the little finger, in the following manner: the extremity of the finger is placed in the greater angle, so that its ball shall fall perpendicularly upon the internal side of the eye, and its back forwards and towards the median line. As soon as the ceratotome presents itself on the side towards the caruncula, its edge is placed at a right angle upon the free edge of the nail, as if to support it; then while it is carried from the external to the internal angle, the nail fixes the cornea, making a slight effort as if to glide out towards the heel of the instrument, until the incision is completed. By means of this manœuvre, well understood and well executed, a neat and regular division may be effected. The eye is neither compressed nor dragged, and the wounding of the neighboring parts can always be avoided. If badly executed, it would be more prejudicial than useful; and the projection of the superior maxillary bone, or of the brow, makes it difficult in most subjects. Unless the nail and the knife glide firmly upon each other, the cornea will not fail to be caught between them, which would completely frustrate the aim of the contrivance. A thin slender finger, armed with a nail somewhat long, is best adapted to this purpose. In a word, it is necessary that the cutting edge of the knife should continue upon the border of the nail without quitting it for an instant, without touching the

ball of the finger, and without allowing the inferior half circle of the cornea to advance towards the root of the nose.

Notwithstanding all these precautions, the iris will sometimes present itself under the edge of the knife. Gentle friction on the eye through the upper lid often causes it to retire, either because by this means we solicit its contraction, or, as appears more probable, because the pressure which is thus exercised upon the cornea gives it its natural position, by forcing the liquid before the caratotome to pass from the anterior to the posterior chamber; or, perhaps, because we straighten the fold by flattening the vitreous membrane. At all events, we never succeed better than when we apply the naked finger on the latter, and compress it gently. The worst that can result from this, is an unnatural perforation of the iris—a second pupil; and this happened to Wenzel, Roux, and Forlenze. Authors give us a number of examples. It has happened to me several times, and I have not been able to perceive that the restoration of sight has been rendered manifestly less complete. I think it less dangerous than to withdraw the knife for the purpose of completing the incision with the scissors, and that prudence permits us to neglect it whenever it is necessary, in order to avoid it, to expose the eye to fatiguing manœuvres.

The elasticity of the sclerotica, perhaps also the action of the straight muscles, is often sufficient to displace the lens, which presents itself spontaneously at the incision immediately on withdrawing the knife, or soon after. It is from this fact that many practitioners have formed the idea of opening the capsule at first, and leaving the expulsion of the cataract until after having carried the operation to the same point on the other eye.

B. Bell, and after him Jung, for fear of breaking up the chrystalline, have proposed to scrape the capsule, instead of incising it. It is a practice essentially vicious, which only the great skill of the able oculist of Germany has been able to spread. Pellier, Siegerist, and especially Wenzel, have thought it would be better to open this membrane with the ceratotome whilst traversing the anterior chamber, than after the completion of the incision. It was easy for Wenzel to reach the anterior leaf of the capsule with admirable promptitude, by inclining the point of the knife a little backwards at the moment it passed before the iris. For less experienced operators, it would be a mere feat of dexterity, an imprudence not without danger. It is a useless complication of the operation to raise, as some wish, the flap of the cornea with a spatula, whilst another instrument is directed towards the pupil. We rarely use the cataract knife for this incision, because it is too large, and because it wounds the iris very easily. The needle of Hey, the little myrtle-leaf of Morenheim, the lance-shaped needle of Beer, would have more advantages, would be more easy to introduce, and to use afterwards. But these are particular instruments which can be well neglected, and replaced by the ordinary crooked needle, or the serpette of M. Boyer, which, because of its convex and round edge, is better suited than the others to open the incision and tear the envelope of the chrystalline. The kystitome, either of La Faye or of M. Bancal, enclosed in a sheath until after its arrival in the pupil, is less likely, it must be confessed, than any of the others to wound the iris. The principal objections to it are, that it is not indispensable, and that it can serve no other purpose than this one.

The lens escapes without difficulty by a puncture in the centre, or a semilunar incision of the lower edge of the capsule, as well as by the numerous vertical and transverse divisions which Beer was in the habit of making upon it, because it tears what resists it; but after it has left the capsule the shreds of the opening approach or fall towards the visual axis, and can, by becoming opaque, produce a second cataract. On the contrary, by making the semilunar incision above, as I have advised, the tearing of the capsule must be from above downwards, so that the resulting fragments will hang below the pupil. Finding it sometimes very difficult to effect the destruction of the capsule, Beer undertook to remove it entirely either with a crotchet, in the cases of capsular cataract, or a small forceps for the encysted, or with the lancet needle for those of the capsulo-lenticular kind. He began by sinking the flat point of this last instrument into the centre of the lens, to which he gave some slight quick movements of elevation and depression, as if to destroy its adhesions; he then turned it on its axis to the extent of a fourth of a circle, in such a manner as to place one of its sides above and the other below; then gave it some slight transverse movements; turned it again circularly, and after having thus completely broken up its organic attachments, withdrew it by jirks and forced it through the pupil. Although Beer affirms that he has many times followed this course with success, it has found, and must continue to find, but very few advocates. In fact, who does not see that the remedy is worse than the disease; that we should succeed better by opening the capsule largely than by detaching it *en masse*, and that by those repeated movements, the lens will most frequently burst it and leave it behind; an occurrence the more probable as the posterior leaf of the capsule is not susceptible of separation from the vitreous humor.

As to the rest, it is rare for this inner half of the chrystalline envelope to be opaque. And this is fortunate; for unless the opacity were very limited, it would be probably without remedy. Even then, I know not how far it will be permitted to follow the counsel of Morenheim and Beer to isolate the opaque spot, and attempt to extract it with a crotchet. Some have thought, when the cataract is milky, of giving vent to the altered fluid; others, when it was membranous, of destroying the capsule only, in order to save the lens *in situ* with its natural transparency; as if in the liquid cataract all the lenticular apparatus was not diseased at the same time, or as if the lens could maintain its properties in a normal state when its capsule had been opened. Whether diseased or not, it should be taken away in all cases, if nothing else prevents. In producing dilatation of the pupil by external means, the preparations of Belladonna render the escape of the vitreous humor very easy, and may thus become more or less dangerous. If we reject them, the pupil remains sometimes so contracted as to hinder the expulsion of the lens. In order to obviate these two inconveniences, Bischoff and others have advised us to open the cornea, then the capsule, and then turn the back of the patient to the light, when the cataract will itself make its escape. By this means the pupil, which is strongly contracted in the first part of the operation, dilates itself without danger towards the conclusion. If it were expedient, we might defer medicinal applications until after opening the eye. But we should, before resorting to active measures, make the patient move the eye about, upwards, inwards, and outwards; because such movements frequently cause the escape

of the opaque body. If from any cause the vitreous humor should escape, the eye-lids must be instantly closed and the head turned backwards. This accident, which entirely destroys the eye where the hyaloid membrane escapes, is much less dangerous than was for a long time thought, in the contrary case. It may even be remarked, that the loss of a certain quantity of the vitreous humor rather increases than diminishes the chances of a successful operation. The escape of the fourth, or even the half of this liquid, must not make us despair of success. There is no evidence of its being formed anew; but the aqueous humor, more abundantly secreted, takes its place, and the functions of the eye are scarcely perceived to suffer.

b. Process of Guerin and Dumont.—With the view of reducing the operation to its most simple expression, Guerin, and almost at the same time Dumont, a cruizing captain of Normandy, invented an instrument which should, by a very ingenious mechanism, hold the eye-lids apart, fix firmly the globe of the eye, and complete at a single stroke the incision of the cornea. The first of these instruments, terminated by a sort of ring at a right angle with the handle, concave behind and moulded exactly to fit the front of the eye, enclosing a blade of the form of a fleam, which is thrown into motion by a spring and escaping the instant it is loosened, opens at once the half of the circle of the cornea, either from below upwards, or the reverse. The ring and the handle of the second are in the same line. Its blade, offering some analogy to the pharyngotome, is made to act from the lesser towards the greater angle of the eye moving horizontally; different from the other, which falls upon the eye like the edge of a guillotine. The instrument of Guerin, of which perhaps the idea was given by the fleam of Van Wy, has been a long time neglected in France, and M. Eckold is the only one to my knowledge who, after improving it, has endeavored to introduce it in Germany. Although more convenient and less dangerous, that of Dumont has not been better received. If those machines of which the ancients were so prodigal, if every species of blind agency is banished with so much care from the practice of other operations by modern surgeons, how much more reason is there for removing them from the eye—an organ so delicate and so easy to destroy! The jar which is necessarily produced by touching a mechanical spring, the fear of wounding some part which it is important to avoid, of making an opening too large or too small, of cutting too near or too far from the sclerotica, have particularly alarmed practitioners. It would be unjust, however, to accord no merit to such conceptions, or to call them at once absurd as some have done, without the means of judging of their utility. Many physicians can attest, with M. Hedelhoffer, that Petit, of Lyons, very often and very successfully used the instrument of Dumont. Modified by the nephew of the inventor, it has even succeeded sixty-two times in seventy-one operations, if all that has been recently reported to the academy be true.

C. *Superior Ceratotomy.*—When the inferior semi-circumference of the cornea is opaque, or altered in any other manner, its division is sometimes quite difficult. The incision will also be ill-disposed to cicatrize. Even when healthy this membrane may be very small, so that it is necessary to raise more than half to obtain a sufficient opening. In such cases Wenzel advises the incision of the superior semicircle, and is said to have succeeded in this way upon the duke of Bedford. Richter gives the same advice, and B. Bell

formally proposed it even for ordinary cases. According to him, the escape of the vitreous humor is less to be feared, the cicatrix of the cornea is formed more quickly, and is less visible and less injurious to the sight than by the ordinary process. M. Wagner published in Germany, that Mr. Alexander, of London, has not hesitated to put the idea of Wenzel to the proof, and Mr. Wilmot, cited by M. Eccard, asserts that Messrs. Lawrence, Green, and Tyrell have often practised it. In France M. Dupuytren has thought proper to try it; but no person before M. Jaeger, successor to Beer, of Vienna, had collected a sufficient number of facts from the living subject to found a general method. With the superior incision, besides the advantages pointed out by Wenzel and Bell, there is nothing to fear from the rubbing of the borders of the lids nor the eye-lashes. M. Jaeger says the tears flow more freely, and occasion less irritation to the incision, which also less frequently suppurates, and procidentia of the iris must be rare. A preliminary difficulty attracted his attention, which is the tendency of the eye to roll inwards or to turn under the upper lid. Here he believes that he has triumphed over all obstacles, by inventing a particular ceratotome formed of two blades, the one narrower than the other, applied face to face in such a way as to resemble the knife of Beer or Richter, when closed. By pressing upon a button at the side, the smaller blade is made to glide upon the larger as in opening a sheath-handle penknife.

The patient and assistant should be placed as in the ordinary method. The operator holds the double ceratotome as a pen, turning the edge upwards and pushing it across the anterior chamber parallel to its transverse axis; conforming in other respects to the precepts above mentioned. This done, he gives the eye its natural position, or even inclines it a little downwards if necessary, and fixes it with the larger blade of the knife, whilst the other blade, set in motion by the thumb of the same hand, produces the incision of the cornea, by sliding from its point towards its heel.

Since in the space of six months M. Jaeger has practised extraction of the cataract sixty times with success, by means of his double ceratotome, it would be improper to assert that the instrument is absolutely bad; *a priori*, however, we can hardly see its advantages. If it is true that we can fix the eye firmly with the stationary blade, whilst its other piece divides the superior segment of the cornea, it must on the other hand traverse the tissues with the more difficulty. Superior ceratotomy, besides, can be very well performed with the ordinary knife; and M. Græfe, who has used it with success seventeen times out of eighteen, and among others upon the Duke of Cumberland, believes it preferable to the double ceratotome. As to the operation itself, of all the advantages which have been accorded it, there are very few that are real. It renders less probable the wounding of the iris, the escape of the vitreous humor, and perhaps the separation of the lips of the incision by the edges of the eye-lids; but the operation in all its steps is certainly more difficult, and less sure than in the inferior operation.*

Dressing.—After extraction the dressing and consecutive treatment differ very little from that recommended after depression. But it is not, perhaps, useless to present some object, not too brilliant, to see if the patient distin-

* This is a method of exception, not of choice, applicable only to the cases indicated by Wenzel; supposing, at the same time, that it is not better to resort to the needle.—*Tr.*

guishes it, before covering up the eyes. It is not to satisfy mere curiosity that this precaution is indicated, but because such proof will give us renewed assurance, when not perfectly satisfied that there does not remain in the eye any opaque substance of sufficient importance to demand extraction. Repose, absence of all movement of the eye, and of the superior extremity of the body, is of absolute necessity. Although the head should be but very slightly elevated, I see no reason which requires us to place it lower than the feet, as done by M. Forlenze. The regimen must be more severe, longer continued, the first dressing a little longer delayed, and the eye less early exposed to the light than after depression.

C. *Comparative Examination of the Two Methods.*

Depression, which was the only method in use until the middle of the last century, because no other was known, fell into such disuse, at least in France, after the publication of the works of Daviel, that, in spite of the efforts of Pott to revive it, it was scarcely practised at the commencement of the present century. The modifications it underwent from Scarpa so far restored it to notice, that at present it is on an equality with extraction, if not above it. Hence the question, which of these two methods is the better, already so much debated and still undecided, presents itself to us every day. Even if it be not incapable of decision, it must at least be confessed that the elements concerned in it are difficult to weigh. What are we to conclude from such a method possessing a greater number of partisans of merit than such another? from Scarpa, Hey, Dubois, Dupuytren, Richter, and Beclard, Lisfranc, Lusardi, Langenbeck, having obtained greater success by depression than by extraction; while with Wenzel, Ware, Richter, Beer, Demours, Boyer, Roux, Forlenze, Pamard, it is the reverse? When an operator, even the most skillful and conscientious, makes choice of one method, his practice, his predilection, always biasses him more or less, and renders him an improper judge of other methods. Nor are the results announced by different men equally qualified, decisive arguments. The success which depression procured to M. Dupuytren does not prove that this operator would have been less successful, if in the beginning he had attached himself with the same zeal to the improvement and propagation of extraction. To show the fallacy of this kind of proof, suppose that twenty of the ablest surgeons of Europe should operate only by extraction, whilst twenty others, taken at hazard, should always have recourse to depression: because the practice of the first shows a greater proportion of success, does it follow necessarily, and from that alone, that extraction is preferable to depression?

Let us see if, after having reviewed the advantages and disadvantages of both, we arrive at any thing more satisfactory. Extraction permits us to take away, without the possibility of its returning the obstacle to vision. It is less painful, and rarely followed by internal inflammation; it exposes neither the nerves nor the vessels to being wounded, and leaves untouched all the interior of the eye, the retina, the choroid coat, the ciliary circle, &c. But in practising it we may wound and deform the pupil, or allow the vitreous humor to escape. If the incision should not heal by the first intention, it ulcerates; soon brings on procidentia of the iris; sometimes atrophy of the globe of the

eye, or at least an extensive opacity of the cornea; the sequelæ of the operation are tedious; it is rare that the ophthalmia which follows it terminates before the fifteenth or twentieth day; in fine, it cannot be used on all subjects, nor at all ages.

Depression merely displaces the opaque body, and leaves it in the eye to continue there a permanent cause of irritation, liable to reascend; it is frequently followed by a secondary membranous cataract, iritis, deep-seated pain, and general nervous symptoms. The needle traverses delicate tissues, wounds of necessity the choroid coat, the retina, the vitreous humor, and sometimes also the iris and the ciliary body. But on the other hand it cannot give issue to the vitreous humor, does not expose the cornea to opacity or ulceration, the iris to procidentia or excision, nor the eye to immediate destruction. The day after the operation the puncture is closed, and the sclerotica, which most frequently is scarcely inflamed at all, resumes, in about eight or ten days, its natural aspect; in fine, if necessary, it can be performed in all cases, and repeated once or oftener on the same organ without running any great risk of injury to the patient.

According to this enumeration, it would at the first glance seem that depression must be superior to extraction. But a profound examination does not permit us to draw a conclusion so clear and positive. The puncture of the sclerotica, choroid, retina, and vitreous body, does not produce much more pain than the incision of the cornea; at least, when performed as I have indicated. The wounding of the nerves, vessels, and ciliary body, is easily prevented, and generally unimportant. When the capsule of the lens is properly torn, we cannot see why secondary cataract should be more common after depression than after extraction. If the lens be well engaged in the vitreous humor, it is difficult for it either to rise again or to hurt the retina. With address we can easily preserve the iris, which the needle never wounds so severely as the ceratotome. But it is erroneous to say that this method is more simple and easy than the other. It is not so easy as may be imagined, to pass an instrument between the uvea and the cataract; to engage it between the lens and its envelope; to make a suitable opening in the capsule to prevent the opaque body from turning either upwards or downwards, if the needle be pressed ever so little in either direction more than in the other, or if the lens should have contracted adhesions to any of the neighboring parts; in fine, it is often only after repeated attempts that we can succeed in getting it down, and fixing it in the bottom of the eye. The greatest address is then necessary to practise depression with every chance of success. If it be generally preferred by inexperienced men, it is much less because of its apparent simplicity than because it does not expose their deficiency so readily as extraction. Again, the irritation which it produces augments the secretion of the humors, producing a feeling of distention in the eye which does not take place after the other operation. Acute or chronic iritis, contracting or entirely obliterating the pupil, may also often be a consequence of this process. The laceration of the vitreous body, although without immediate danger, may not be always exempt from inconvenience. The lens, which does indeed sometimes disappear by absorption or dissolution, more frequently retains its form and volume for some years or for life; whatever the moderns may say of it, after Pott, Scarpa, and Dablin, who in 1722 proved its absorption, and concluded that it

constantly disappears after depression. Beer has seen it rise again at the end of twenty-six years. Of twelve patients operated on by depression, whose eyes I have had an opportunity of examining in the hospital after death, one, two, two and a half, and four years after the operation, it had scarcely diminished one fifth in the only subject in which there was any sensible alteration. In others it had formed, through the intervention of some laminæ of the hyaloid membrane, adhesions to the retina and choroid coat, itself presenting a sort of knob or cicatrix about three lines long. M. Campaignac, who has made many researches, especially on this point of practice, also says, after numerous observations, that the lens is far from disappearing so quickly or so constantly as is generally believed after depression. This is an inconvenience, it must be confessed; and an inconvenience that no argument can destroy, and which will always render the operation by depression less complete than that by extraction. Keratonyxis, which Dr. Wedermeyer rejected after having tried it fifty-three times, will succeed no better; and, whatever M. Schindler, who defends it, may say, it would be a poor way of securing supporters, to penetrate as he does at the centre of the cornea, instead of the lowest point. Escaping, or left in the anterior chamber, either whole or in small fragments, the lens is far from dissolving as promptly as some authors pretend. Observations made by M. Plichon, at La Salpetriere, prove that it often acts as a foreign body, and if not soon removed exposes the eye to serious dangers. Another defect, still more important, is the following: the iris may remain movable, and the pupil clear, and the whole organ bear the appearance of perfect integrity, yet the vision may be totally destroyed. I have seen, at the central bureau, four persons who had been operated upon at Paris, blind from this cause. A man, aged sixty-two years, on whom I operated in 1829 at the hospital of *St. Antoine*, has recently asked my advice. At first sight any one would affirm that his vision was perfectly good. The pupil is of a beautiful black; round, regular, movable; neither dilated nor contracted too much, and yet his blindness is complete. What has so often imposed upon the partisans of depression is, that the patients seem so often to recover their sight after a certain time, and keep it, in fact, during a month or two, but afterwards find it gradually growing weaker, until in less than a year it is entirely gone. If the operation, repeated seven times in one case, six times in another, and thirteen times on each eye in a third, have enabled Dr. Hey to cure his patients, it does not make it the less true that these secondary attempts are most frequently unsuccessful. The truth is, however, that the consequences are commonly trifling. After depression there almost always remain, or are formed, some particles, more or less opaque, before the vitreous humor. Experience proves that after extraction this accident is much more rare.

As to extraction, it is evident that the section of the cornea is much more delicate than the perforation of the sclerotica; that in spite of every precaution the vitreous humor may escape, the iris be extensively wounded by the knife, or ruptured or torn by the lens; yet if the operation is well done and the patient in good condition, two accidents only, the escape of the vitreous humor and the consecutive opacity of the cornea, can render it dangerous: while, all other things being equal, it gives a result immediate and definitive, and more satisfactory than that of depression. But it must be said that the escape of the lens endangers two other accidents. Although largely dilated

by the belladonna, the pupil almost always contracts enough to oppose some resistance to the opaque body, which then tends to tear up the iris from below so as to escape, if the pressure on the eye be not conducted with extreme caution. This pressure, brought suddenly upon the cornea by an unexpected movement of the patient, may, if it occur at the moment the edge of the cataract presents itself at the flap, push it up over the vitreous humor; leaving us in doubt whether it has really escaped or is yet in the eye, as once happened to me. Procidentia of the iris, which is more frequently a consequence of the operation in old persons, because of the slowness of the cornea to cicatrize in them, is treated by mechanical means or belladonna if there be no adhesion, but with the nitrate of silver if there be; and is not more difficult to cure in these than in other circumstances. When an operator desires to leave no opaque particle in the eye, there is no objection to throwing in one or two injections of lukewarm water through the incision with Anel's little syringe. Perhaps it would be even advantageous to imitate M. Forlenze, and adopt this method generally. In a word, if the dangers of extraction are more serious and apparent, those of depression are more numerous and real. Operators of equal skill avoid more easily those of the first than those of the second; and if the employment of the needle fails less frequently to procure *some* benefit to the patient, the method of Daviel furnishes in compensation a greater amount of complete cures. I conclude, then, that when circumstances occur which render it indifferent which of the two may be used, extraction should be preferred; but in other cases sometimes one may be adopted, and sometimes the other.

Depression appears preferable, for example, upon infants and intractable subjects, when the eyes are small and sunken; when the cornea presents spots of opacity, is small or flattened; when the eye-lids or the conjunctiva has been a long time diseased; when there is cause to apprehend active inflammation of the appendages of the eye; when the cataract is completely fluid; when the pupil is contracted, or the iris adheres to the cornea; when the eye is very prominent or very irritable. Extraction, on the contrary, offers greater advantages with old persons, and even adults, if the anterior chamber be large; the lens very soft or very hard; the cataract membranous or adherent; the eye perfectly healthy, not very sensitive, and susceptible of being pierced without difficulty. I should add, in concluding these remarks, that any surgeon would sin against humanity if he should practise the operation for the cataract before he had exercised himself at first a long time upon the dead body, and afterwards upon living animals. Yet it must be stated that this kind of experiments are far from giving an accurate idea of what really exists in the living subject; and that extraction alone can be simulated in a way at all satisfactory.

Surgeons have long felt the want of a means of producing artificial cataract, to give the means of preparatory practice upon animals and dead subjects, and leave the eye at the same time all the mobility which renders it so difficult to be fixed at the moment of operation upon the living. Troja, in Italy, and M. Bretonneau, in France, have made some attempts to render the lens opaque by the aid of acids. M. Leroy thought it could be better accomplished by means of electricity; but no person before M. Neuner, of Darmstadt, made it a particular object of study. The liquid he used with greatest

success was a solution of six grains of corrosive sublimate in one gros of pure alcohol. A small glass syringe garnished with platina, terminated by a very fine pipe, and traversed by an extremely fine stylet that passes through both extremities, is used for the purpose of introducing to the lens from behind a few drops of this solution, which soon causes that body to change its color.

Among the machines invented to represent on the eyes of the dead subject the principal difficulties met with on the living, the ophthalmophantome of M. Sachs is certainly the most ingenious: composed of a stand, a mask, and a porte-œuil, of which I cannot here give a description. It appears to me too complicated ever to come into general use.

After one of the chief refractive agents of the eye has been either removed or displaced, I need not say that almost every individual operated on for cataract should wear such convex glasses as are used by near sighted persons. With children, those who have been blind from birth, and all subjects, in fine, who for the first time are beginning the cultivation of their sight, it is well to add to the precautions generally used a very simple resource employed with success by M. Dupuytren, which consists in fixing the hands behind the back, so that being deprived of these assistants they are forced to make greater exertions with their eyes in directing themselves towards external objects.

§ 4. *Artificial Pupil.*

Two very different states may require the establishment of an artificial pupil: opacity in the cornea, or the contraction or obliteration of the natural pupil. In the first case, whether the obstacle to vision may have been the result of simple ophthalmia, ulcer, wound, or any other lesion, is of little importance. Provided the internal parts of the eye be unaffected, and there remains a transparent portion of the cornea, the formation of an artificial pupil may be tried. In the second, whatever be the cause or degree of the disease; whether it be simple or complicated with adhesions, the operation is practicable if the retina have not lost its faculty of perceiving luminous rays, and the anterior chamber preserves its transparency. If this last condition be wanting, it is useless to make a new pupil for the transmission of light, for the impression will not be felt. Acute and chronic inflammations of the internal tunics, as well as every kind of alteration, the course of which has not been definitively arrested, are contra-indications, which, although less absolute, are yet sufficient, with some exceptions, to arrest a circumspect surgeon. Almost all authors advise not to attempt it when there is only one eye affected, or even otherwise when the patient is able to conduct himself without a guide. As the operation is itself sometimes followed by accidents capable of deeply affecting the vision, it appears but little conformable to the laws of humanity to expose the sufferer to the loss of the little that yet remains, when the chances of amelioration are so precarious.

A. *Methods of Operating.*

Every process invented for forming a new pupil may be reduced to three methods. The first, *iridiotomy* or *coretomia*, consists in *incising* the iris; the

second, *iridectomia* or *corectomia*, in *excising* a piece of this membrane; and the third, *iridodialysis* or *coredialysis*, in detaching its circumference at some point.

1. *Coretomia or the Method by Incision.*—No one before Cheselden had spoken of this process. Since his time it has attracted the attention of Woolhouse, Mauchart, Sharp, Sprægel, Meiners, and Rathleau, who have proposed it in case of a persistence of the pupillary membrane; of Odhelius, Guerin, Janin, Wenzel, and of Messrs. Maunoir, Adams, &c., who have subjected it to several modifications. The patient, operator, and assistants must be placed as in the operation for cataract.

a. Process of Cheselden.—With a small knife in the form of a scalpel, cutting on one side only, Cheselden penetrated through the sclerotica, as in couching, as far as the uvea, and passed the point of the instrument into the anterior chamber. Then directing it inwards and backwards according to some, or according to others from the internal angle to the external, and from behind forwards, he completed a transverse incision from two to three lines long in the centre of the iris. A pupil of an elliptical form, similar to that of some quadrupeds, was the result of this delicate operation, which succeeded well and forcibly attracted the attention of the learned.

b. Process of Sharp.—In practising coretomia Sharp claims to have done nothing more than to imitate Cheselden. A little scalpel slightly convex on the back, of which he gives a figure, is at first carried horizontally, the edge turned backwards, into the posterior chamber between the circle and the root of the ciliary processes. It is then enough to incline the point more or less anteriorly, and give it a slight push to penetrate into the anterior chamber. It remains to cut the iris either on a level with or below, or which is better, above the natural pupil. The opening produced by this operation, which continues for some time, never fails to contract, and at last even to become entirely closed. Even Sharp appeared to have little confidence in Cheselden's method. Mauchart deserves to be mentioned here, only because he was the first to suggest the idea of passing the instrument through the cornea or anterior chamber in forming the pupil. He objects, besides, to giving the artificial opening too great an extent, because, as he remarks, this kind of a pupil can neither dilate nor contract spontaneously like the natural one. Henkel also preferred to penetrate through the anterior chamber. Huermann, who is of the same opinion, advises us to use an ordinary lancet instead of needles or the knife of Cheselden, to cut the iris and cornea.

c. Process of Odhelius.—After having pierced the cornea as for the extraction of cataract, Odhelius cut the iris from the centre to the circumference in a subject whose cornea was opaque opposite the pupil, which was also contracted. By this means he obtained a triangular opening—the base being the remains of the primitive pupil, and thus completely restored the sight.

d. Process of Janin.—Having frequently tried Cheselden's method without success, Janin thought to succeed better by giving a vertical direction to the incision. The transverse one soon and almost necessarily closes itself, he said, because the radiating fibres of the membrane are only separated, whilst they are really cut by a perpendicular incision made a little to the inside of the natural pupil. It was an accident that led him to this modification.

It happened to him as to many others, to cut the iris in performing the operation for extraction; making thus against his will an artificial pupil at the side or rather below the natural one. Seeing that this opening made by chance did not close, whilst those which he had made by design were always obliterated, he endeavored to profit by his mishap, and set himself to mature the process which chance had pointed out. Instead of scissors, Kortum advises us to cut the iris vertically with the same ceratotome which is used in dividing the cornea. But in spite of the experiments of Weissemborn and the observations of Pellier, which tend to confirm its advantages, the method of Janin was soon abandoned by practitioners. It was not long before it was found that a pupil so formed does not remain much longer than that formed by any other method. Like Pellier, Huermann, and Henkel, Janin penetrated through the anterior chamber.

e. Process of Guerin.—To obtain the advantages of both, Guerin proposed to combine the methods of Cheselden and Janin; that is, to make a crucial incision instead of one simply vertical or transverse. But on the one hand the operation is then more difficult, and on the other it is not rare to see the four flaps approximate so as to prevent the light from reaching the bottom of the eye; so that the practice has not much to recommend it. When vision is prevented by leucoma, *Pellier* enlarged the natural pupil, instead of cutting out a new one. For this purpose he opened the cornea as if for extraction, passed a small grooved probe into the posterior chamber of the eye, which served to direct a pair of small scissors, and then divided the iris outwards, inwards, or upwards, from the pupil to the ciliary ligament.

f. Process of Maunoir.—Although the result of the individual researches of its author, the method invented by Maunoir seems to be but an improvement of that of Pellier. This surgeon, by means of a ceratotome or lancet, made an opening from two to three lines long in the inferior and exterior part of the cornea, through which he introduced a pair of very small scissors bent at an angle near the handles, one of the blades of which terminated in a head; opens them in the anterior chamber, and passes one blade through the iris into the posterior chamber, so that the other with the button remains behind the cornea; thus seizing the membrane, he incises it first inwards, then outwards and upwards so as to form a triangular flap, the adherent base of which is towards the circumference and the free summit towards the centre of the eye. The scissors-needle, invented by M. Montain for the purpose of avoiding the previous division of the cornea, although ingenious, offers no improvement sufficiently useful to merit the preference claimed for them by the inventor. By the double incision the circular fibres which M. Maunoir admits in the iris are twice cut, while its radiating fibres remain untouched; these by their contraction tend to dilate the new pupil, the reverse of which takes place in Cheselden's operation. The ideas of the surgeon of Geneva have received the sanction of the celebrated Scarpa, who in defence of them renounced his own method. This method has also found partisans in Germany; but in France and England it is generally neglected. Above all, it is evident that if it be desirable to attempt coretomia in this manner—of which M. Carron declares himself the ardent defender in an unpublished work which I have before me—it may be advantageously modified by using, as I have several times done, an ordinary ceratotome for cutting the triangular

flap of the iris; doing by design what is so often done by accident in the operation for the extraction of the cataract: what Wenzel appears to have advised, and what Odhelius performed.

g. Process of Mr. Adams.—Lately Sir William Adams has revived the method of Cheselden, with this difference, that instead of a straight knife like Sharp's, he employs a small scalpel, convex on its edge; that he breaks up the lens if it be opaque, and tries before quitting the eye to engage some of the pieces in the transverse incision of the iris, to prevent its closing. M. Roux used this method several times whilst I was his assistant, and in every case the new pupil finally disappeared. Besides, it appears not to have received much confidence in the author's own country; for it scarcely appears to have been tried by other surgeons. I have not myself been more happy in two attempts which I have made.

Coretomy was still further modified by Jurine, Langenbeck, Weller, Faure, Wardrop, who carried a needle into the posterior chamber; penetrated the iris from behind into the anterior chamber; then passing again in the opposite direction through this membrane in the internal angle of the eye, returned the point of the instrument into the posterior chamber; then united the two little wounds by means of one of the edges of the instrument rather than the point, detaching one of the extremities of the flap which they had circumscribed. But it has found numerous antagonists recently among the oculists of Germany. They object to it, that in passing the needle through the iris, either from the anterior or the posterior chamber, a lesion of some of the apparatus of the lens is almost inevitable, becoming one of the most ordinary causes of cataract and rarely followed by permanent success; that it is difficult of application when there is an opacity of the cornea, or if there exist adhesions or even simple synechia of the iris. Although all those objections have some foundation, they are not of a nature to make us reject the operation entirely. I have thought too of modifying it still farther.

h. Process of the Author.—I use a knife a little longer and narrower than Wenzel's, cutting on both edges as far as four lines from the point, and dull or rounding from thence on the back to the handle; an instrument of which the lancet called the *serpent's tongue* will give a very good idea. Held as a pen, it is pushed like any other ceratotome through the cornea from the temporal side of the orbit a little obliquely backwards. When it has reached the anterior chamber, the point is to be passed with great care through the iris into the posterior chamber, so that it may be easily returned through the same membrane at another point into the anterior chamber, leaving an interval of two or three lines. Then continuing to push it on until it pierces the cornea a second time, it is easy to divide the kind of bridge that covers its anterior face, and only to detach completely one extremity of the flap, after having reduced the other to as small a pedicle as may be desired. A division can thus be obtained equivalent to a loss of substance. The small flap that is made will not fail to contract upon itself, and eventually must be lost in the aqueous humor. When the manœuvre is well executed, it is even possible in most cases to excise the piece entirely. In fact, if the instrument acts equally upon the adherent sides of the flap at the moment the section of one side is performed, it is sufficient to advance the ceratotome a little, and

incline its edge towards the cornea in order to detacn the other, and convert *coretomy* into *corectomy*.

2. *Coredialysis.*—To Scarpa is due the introduction of this method. Many authors, however, had spoken of it before him. Sharp, for example, remarks in speaking of coretomy, that when pressed by the instrument the iris is often detached from its insertion instead of divided. In a patient treated for cataract by Wenzel, the lens escaped through such an accidental opening. The natural pupil afterwards almost entirely disappeared, but the patient continued to see through the abnormal opening. If Assalini may be believed, Buzzi, of Milan, who practised coredialysis as early as 1788, passed the needle through the posterior chamber into the iris at a line from the obliterated pupil, and by well managed tractions detached this membrane from the ciliary circle. A. Schmidt, who published a good memoir on the subject in 1803, is said to have used it in 1802, and to have conceived the idea of it in 1792.

a. Process of Scarpa.—When his needle has reached the interior of the eye, the same as for depression, Scarpa turns the concavity forwards, passes it behind the internal and superior part of the uvea, and presses the point through the iris into the anterior chamber; then using it as a crotchet, with a kind of see-saw motion, downwards, forwards, and outwards, until it detaches the greater circumference of this membrane for about two or three lines, so as to produce an opening a little larger than the natural pupil.

b. Process of T. Couleon.—Tache Couleon among the earliest, Flajani, Himley, Beer especially, and Buchorn, advise that the needle, either straight or curved in any manner, be passed through the cornea, and not the sclerotica, as done by Scarpa. According to them, it is as possible in this manner to make the new pupil on the outside as on the inside, besides giving the operator a better opportunity of seeing what he does, and making the puncture of the eye less dangerous.

c. Process of Assalini.—After having made an incision at the external angle of the cornea, Assalini introduced into the anterior chamber a fine curved forceps, with which he seized the iris at a little distance from its ciliary border and detached it, as in Scarpa's method. This forceps appeared useless to Bonzel, who replaced them by a very small crotchet used in the same manner. Dzondi employs a kind of forceps, one of the branches of which is grooved on the internal face to receive the other when the instrument is closed. He asserts that there is no risk of tearing the iris with this instrument, and that it is easier to effect the detachment with it than with any other.

The strongest and best founded objection to coredialysis is, that the detached border of the iris resumes after a little while its natural position, and that after a certain time the new pupil is always closed.

d. Process of M. Langenbeck.—To obviate this inconvenience, M. Langenbeck, after seizing the iris by means of a little crotchet protected by a sheath, and drawing it gently towards him, engages it in the wound of the cornea, which should be very small, and fixes it there as if to produce *myocephalon*, and then disengages his instrument with the utmost caution. The adhesions which soon form in this kind of hernia prevent the pupil thus made from contracting, and give the operation every necessary security.

e. Reisinger, who professes the same idea, objects to the sheathed crotchet of M. Langenbeck, and uses a simple ocular forceps, the point of which is

curved in a hook on one side. This forceps is introduced flat and closed into the anterior chamber; then, with the concavity turned away, it is opened one or two lines, and closed again after having been sunk into the iris. This membrane, being thus pinched or grappled, is detached and drawn out, so as to produce an artificial procidentia. The coreoncion, so much boasted of by M. Græfe, is employed in the same manner as the crotchet of M. Langenbeck, and differs little from it otherwise than by a small ceratotome which it has at one of its extremities.

f. Process of M. Lusardi.—Very recently M. Lusardi has proposed to reduce coredialysis to its greatest simplicity, by inventing a crotchet-needle which is sufficient alone to perform the whole operation. This instrument when closed has the form of Scarpa's needle, or rather of a very small hook-knife. Its two shanks are so disposed, that by drawing the shortest a little back—that which corresponds to the concavity—there results an opening which transforms it into a real forceps. It is introduced through the cornea as if for ceratonyxis, then passed by the anterior chamber, if that be free; if not, by the posterior chamber, after having penetrated the iris at the ciliary circle. Arrived there, the surgeon applies the back against the greater circumference of the ocular diaphragm, which he endeavors to detach by swaying the instrument; then opens the needle and allows it to spring, and the membrane is caught. There is then nothing to do but to draw it towards the opening in the cornea, with such precautions as are necessary to produce a new pupil of proper dimensions. With this instrument, which had already been described in Italy by Donegana and Baratta, M. Lusardi thinks there is no risk of injuring the capsule of the lens—which is not proved—and that he can establish an artificial pupil upon any point of the ciliary circumference, which is more correct; but the ordinary needle offers nearly the same resources; and the most important advantage whicn I can see in this serpette is, that it enables us to excise a part of the iris; to have recourse to corectomia at once, if there be any cause to fear that coredialysis may be insufficient. I shall not speak here of the method of Assalini, who, to remove the new pupil as far as possible from the lens, advises us to destroy a part of the circle and of the ciliary processes at the same time that we detach the great circle of the iris; it is too directly contrary to the end proposed for any surgeon ever to have recourse to it.

g. The Method of Donegana does not deserve the same proscription. Seeing that after coredialysis, according to Scarpa's method, the new pupil almost always ultimately closes, this oculist has proposed, to prevent that inconvenience, to unite the method by incision to that by detachment. Consequently he incises the iris parallel to its radiating fibres from the greater towards the smaller circumference for about two lines, after having detached it from the sclerotica. For this purpose we may penetrate through either chamber, and use an ordinary needle, or an instrument with a blade a little thinner, almost straight, and very sharp. Unfortunately it is not as easy, however, as one would suppose, to cut the iris after detaching it in the interior of the eye. It folds under the knife, and tears or separates from the neighboring parts much easier than it divides. However, this is an improvement that may be of some assistance, and which it would be advantageous to attempt when we wish to practise this operation according to Scarpa's principles.

3. *Corectomia.—a. Wenzel* appears to have been the inventor of corectomia. Yet it cannot be denied that Guerin had practised it before him, who, as remarked by Sprengel, sometimes excised the point of the flap of his crucial incision. Sabatier, who adopted the practice of Wenzel, has given us the most satisfactory idea of it. The first steps are the same as for extraction. Whilst crossing the eye the knife is made to form a flap in the iris similar to that of the cornea. A pair of small scissors introduced into the anterior chamber is then used to separate it at the base, seizing it at the same time at the point with a pair of small forceps, if necessary. An opening is thus obtained by removal of substance that offers every chance of success.

b. Process of M. Demours.—M. Demours thought proper to pursue a method somewhat different in case of the existence of leucoma. He made an incision into the anterior chamber, which comprehended at the same time both cornea and iris; then with two cuts of a pair of scissors he circumscribed and took away a flap from the latter about as large as a leaf of sorrel. The difference between these two methods is but trifling. If the first offer some advantages by permitting us to stop at *coretomy* when that is deemed sufficient, the second exposes less to the danger of evacuating the eye. To one or the other may be ascribed the principal processes extolled by the oculists of the present day.

c. Process of T. Couleon and Dr. Gibson.—Like Wenzel Dr. Gibson opens the cornea at first as largely as if for extraction of a cataract, but does not touch the iris. He then forces this membrane through the incision by means of gentle pressure upon the globe of the eye, and with a pair of scissors excises a disc of suitable dimensions. M. Forlenze does not hesitate to open the cornea for two-thirds of its circumference, so as to seize the iris with a forceps or a crotchet, and remove a flap, like M. Demours. In a thesis defended in 1803, M. Morault ascribes a similar method to T. Couleon.

d. Beer asserts that an opening of two lines in length in the cornea is sufficient for the iris to become spontaneously engaged, and that then we may excise the part that attempts to escape. If this do not happen, he draws the membrane towards him by means of a hook.

e. Process of M. Walther.—For the purpose no doubt of reconciling the principles of Gibson with those of Beer, M. Walther opens the cornea for about three lines, draws the iris outwards with a crotchet, and excises a flap of suitable size with a pair of small scissors. By an opening nearly similar, M. Lallemand, of Montpelier, has been able to seize the membrane with the small crotchet forceps, draw it towards him, and excise a considerable piece, thus forming an elliptical pupil similar to that of the cat, vertical, and two lines broad and six long. The success was so complete, says the author, that the patient is able to follow the army of Spain as overseer of an infirmary.

The forceps-needle of Wagner and Dzondi, the *raphiankistron* of Emden, the *iriankistron* of Schlagintweit, and the method of Himley, do not differ enough from those above mentioned to justify me in detaining the reader with them. I will say the same of the method of Autenrieth, which consists in destroying a portion of the sclerotica, of the ciliary processes, and cirule; in taking away, in short, a disc from the ocular shell, behind the cornea, taking the simple precaution to close the opening with the conjunctiva, which is to

be previously separated. The best that can be done for such an idea is not to speak of it.

f. Process of Dr. Physick.—After having cut the cornea and iris in conformity with the precepts of Wenzel, Dr. Physick introduces into the anterior chamber forceps terminated by plates, somewhat similar to our chimney-pincers. The inner face of these plates presents at their circumference a cutting edge, forming a pair of scissors of a peculiar kind, with which it is easy to seize and remove a flap of the iris after a stroke of the ceratotome.

B. *Relative Value of the Various Methods.*

These various methods show at least the ceaseless efforts of practitioners to improve one of the most delicate operations in ocular surgery. Unhappily there are obstacles and difficulties often met with here which the greatest address, the most consummate ingenuity cannot surmount. Considered in an abstract point of view, there is no doubt that *corectomia* is superior to the other two methods. Yet in practice, as the instrument used must cross the anterior chamber, it is almost impossible to have recourse to it when the iris adheres to the cornea, or when the latter membrane is opaque for a considerable extent. *Coretomia* presents nearly the same inconveniences, without all its advantages; and besides, experience proves that the opening it produces rarely persists more than a few weeks. To coredialysis then must be accorded the preference. It is the same in case of adherent membranous cataract, or an opacity of any kind before or behind the iris which cannot be destroyed; observing that we are forced to carry the pupil towards the circumference of the iris. Only coretomia and coredialysis permit us to operate by *scleroticonyxis*. Yet as they can be as well performed by *keratonyxis*, we should prefer the former only in cases of very distinct *synechia anterior*, because it renders a lesion of the lens almost inevitable. Should any one desire to perform coretomia without trying the process which I have contrived, I would recommend to him that of M. Maunoir, or that of Wenzel, which is still better. For corectomia we may use indifferently the method of Demours, Forlenze, Gibson, Beer, or Walther; although the best of all in my opinion would be that of Physick (as I have modified it), if it were possible to get an instrument small enough and finely finished, which I have not yet been able to do. When it has been decided to perform coredialysis, the simple crotchet of Bonzel will answer all the purposes of the more complicated instruments of Beer, Reisinger, &c.; but I doubt whether it be as easy as it seems to be admitted by these authors, to fix in the opening of the cornea the portion of the iris which has been with more or less difficulty drawn out. If the accident which we hope to remedy by forming an artificial pupil be manifestly the consequence of an operation for cataract, there is then much less inconvenience than in other cases in passing the instrument by the posterior chamber. But then at the same time the eye is too much altered to permit very great hopes of success. It is evidently unnecessary to open the anterior chamber as largely as advised by Wenzel, Forlenze, and Gibson. If the lens and its capsule be healthy, it is otherwise. Yet if there be any suspicion of opacity in these parts, it is better to extract them. Perhaps we should even make it a rule to extract them whether opacity had commenced or not. By this means we would escape the unpleasant sight

of a consecutive cataract making its appearance to destroy the chances of success of the primary operation, as happened to me in a man aged thirty years. With this view the opening of the cornea could not be too large, since we operate for cataract and artificial pupil at the same time. When there are opaque spots on the eye, and when *keratonyxis* cannot be performed, the case becomes very embarrassing. If the incision be upon the healthy front of the cornea, the cicatrix resulting from it and the inflammation which follows it, too often destroy the little transparency that the primary disease had left. The leucomatose portion, on the contrary, we have cause to fear will suppurate and cause the loss of the eye. Yet many practitioners, and among them Fause and Lusardi, have remarked that the section of a cornea thus opaque is not so dangerous as it is generally thought to be; and they go even so far as to say it agglutinates more rapidly than when it is not thus diseased. This is easy to be conceived; for such tissues being less sensible, less excitable, nearer the state of vegetative life, must inflame more moderately than if in a perfectly normal state. If then the cornea be opaque to a great extent, we must husband carefully that part which yet remains good, and penetrate through the altered portion. In the opposite case, when the transparency is affected only in a small and very circumscribed spot, it is better to cut the sound tissue. To be prepared for every exigency, every variety of form under which the disease may present itself, it is well to become familiarized with the various methods I have detailed, each of which may at times offer peculiar advantages. I will add, however, that the method by excision is the only one which offers ultimately any real chances of success. All the methods by incision, either simple or complicated, as well as that by detachment, are decidedly bad, and should be adopted only by way of exception. I have performed this operation according to the precepts of Scarpa, Wenzel, and Maunoir; and although the artificial pupil has remained large enough for some time, it has always ultimately reduced itself to almost nothing. I have recently practised upon a young girl the method of Odhelius, and although the opening appeared at first very large, it has already begun to contract. These facts and the wounds of this same membrane during the operation for cataract, have satisfied me that the various methods based upon the supposed muscular nature of the iris are built upon a false foundation. Instead of retracting itself towards the root, the flap of the iris which I made in 1829, at *St. Antoine*, on a man sixty years of age, on the contrary, approximated little by little towards the point from which it had been separated. The same thing happened to me in 1831, at La Pitie.

After the operation the patient must be subjected to the same regimen and the same precautions as if he had been treated for cataract. Yet the consequences are rarely as serious. After keratonyxis and even scleroticonyxis, they are often reduced to the slightest inflammatory symptoms. If the patient has not completely or for a long time lost the habit of perceiving light, we can frequently dispense with confinement to bed, and be content with making him wear a bandage of black taffeta for some days. The lady operated on by Wardrop, returned in a carriage immediately after without any bad result. An ungovernable subject, upon whom I could impose no rules of conduct, got up the same night of the operation, would not submit to any retrenchment in his aliment or change in his habits after the expiration

of the next day, and this without being affected with the least inflammation. Of seven others upon whom I operated, none suffered from inflammatory symptoms. But when we have performed keratotomy; when we have opened the cornea extensively, like Wenzel, &c.; when we have thought it necessary to extract the lens or its appendages; and when the natural pupil has been completely closed for a long time, it would be very imprudent not to enforce exactly the same regimen as after an operation for cataract. In all these cases the most intense ophthalmia may be easily induced.

§ 5.—*Puncture—Incision.*

Puncture of the eye was formerly employed in onyx, or effusion of pus between the lamellæ of the cornea; in hypopyon, or abscess of the anterior chamber; empyesis, or abscess of the posterior chamber; hydrophthalmia; buphthalmia: and in all cases, in fine, where the eye was the seat of an excessive accumulation either of its own natural humors, or of any abnormal liquid.

1. *Onyx.*—When the small purulent spots which sometimes form in the thickness of the cornea have been vainly combated by antiphlogistics, emollients, discutients, &c., nothing appears more rational than to open them. The operation is, however, so simple, that it is scarcely worth describing. The surgeon, depressing the lower lid whilst the assistant elevates the other, seizes, with the right hand for the left eye and the left hand for the right eye, an ordinary lancet, bare or enveloped with a ribbon nearly to the point, and divides the layers of the cornea which separate the onyx from the exterior with all necessary caution, repeating the puncture as often as the separate abscesses in the front of the eye may require it. A cataract needle will do as well as a lancet, and any pointed cutting instrument will serve. Unless the transparency of the cornea be utterly destroyed, the instrument should be carried as far from the centre of the organ as the disease will admit, and penetrate rather obliquely than by a perpendicular incision. Some surgeons disapprove of either puncture or incision in these cases. It aggravates, they say, or reproduces the inflammation, leaves indelible cicatrices, and may produce other serious injuries to the eye. Besides, the matter forming the onyx, almost always adherent to the lamellæ, is rarely so fluid that it will escape from a simple incision. Finally, this pus disappears of itself when the ophthalmia which produced it is entirely removed. Although adopting some of these reasons, I think the operation useful when the pus is gathered into a true sac, in a fluid or concrete mass large enough to take away all hope of its disappearance without surgical aid. The facts which science possesses, and the late labors of M. Gierl in particular, seem to me to show that the puncture of the eye offers us then some undeniable advantages, and that the moderns have exaggerated its possible bad results.

2. *Hydrophthalmia.*—The puncture of the eye for hydrophthalmia, whether attended or not by the liquefaction of the vitreous humor or the extravasation of blood or pus, is a means of relief not so often resorted to at the present time. It would be imprudent, doubtless, to commence the treatment by it; but when general therapeutic means and topical applications have been tried without success, and the distension of the eye continues, I can see nothing more rational than paracentesis of the eye. By removing the compression of

the retina, the iris, the ciliary circle, processes, vessels, and nerves, it calms the most violent pains, and appears to me capable of preventing most serious consequences and becoming a most important palliative, if not curative means. Though used in Japan and China for some centuries, and practised by Tuberville and Woolhouse, this remedy does not appear to have been formally proposed by any one for hydrophthalmia, before Valentini, Nuck, and Mauchart. Woolhouse advised the puncture of the sclerotica, and Nuck of the centre of the cornea. Puncturing, properly so called, is now generally abandoned. It is in almost every case advantageously superseded by incision. Some prefer to open the anterior, others, M. Basedow for example, the posterior chamber. Bidloe opened the inferior part of the cornea with a hawk-billed lancet. Meckren used a large triangular needle made for the purpose. At the present time a cataract-ceratotome is most usually employed. Saint Yves divided the cornea transversely. Louis dislikes too large an opening. Heister advises the incision of the sclerotica. Others are for puncturing first, and extending the opening with scissors or some other instrument. But amongst the whole the choice truly lies between Bidloe's, or rather Galen's method, and that of Maitre-Jean and Heister. None of the others accomplish the purpose so well, and most are more complicated or much more dangerous. The incision of the sclerotica either outwards or downwards, or parallel to the fibres of this membrane, reduces itself in effect to a trifling puncture, and would be preferable if the aqueous humor could always escape thereby. But unhappily this is not the case. Even in simple hydrophthalmia it is evidently necessary in dividing the sclerotica, to do the same with at least two lines of the ciliary circle, which must make this operation more dangerous than the division of the cornea. It is only then when the disease affects the vitreous body—differing from simple hydrophthalmia—that Heister's method offers any advantages; yet even in that case it is of little importance which be pursued, as the eye is in most cases utterly lost.

Operation.—Having disposed the patient and assistants as if for the extraction of a cataract, opened the lids, and fixed the eye, the surgeon, with the point of a lancet, bistoury, or ceratotome, held as a pen, makes an incision of two or three lines through the inferior or external part of the cornea, as far from the pupil as possible without wounding the iris. The aqueous humor soon escapes; there is no necessity for pressure. A very manifest relief is generally the immediate consequence. As there may be some hope of saving the eye, nothing should be done to prevent the cicatrization of the wound. It should be dressed as an operation for cataract, and the puncture renewed after some days (according to M. Basedow, who reports four instances of success), if a new accumulation of fluid seems to require it. No one would now advise us to imitate Nuck and some of the surgeons of the last century, in putting a plate of lead between the lids in order to press the eye backwards and make it gradually retire into the orbit. Such a practice, in itself unworthy of discussion, could only have been adopted by those who confound exophthalmia, buphthalmia, and proptosis with true hydrophthalmia.

If some point of the tunics of the eye be more manifestly altered, prominent, or thinner than the others, it should certainly be preferred to the point above indicated for the paracentesis. When in buphthalmia the projection of the eye depends upon dropsy, upon a forced dilatation of the sclerotica, it is

still hydrophthalmia, and indicates the same operation as above. On the contrary, it will be of no use, and will only aggravate the condition of the patient when the disease is caused by the development of some humor, or by the existence of some organic lesion of the orbit.

3. *Hypopyon.*—Galen seems to have been the first to propose paracentesis for hypopyon. Yet he did not have recourse to it until after having vainly tried succussion, so much extolled by Justus, and which Heister and Mauchart since have not disdained to try. According to this author, the inferior part of the cornea is to be opened a little anterior to its union with the sclerotica, and the pus soon flows forth. Aetius advises the use of a needle at some point of the membrane that is uninflamed. G. de Chauliac, Benedetti, Pare, and Dionis have followed the direction of Galen with success; and in spite of the efforts of Nuck, Woolhouse, and many others, who, like the Arabians, advised us to be content with a puncture to give air to the matter; who even go so far as to recommend leaving a canula in the place, which may be used for making injections into the eye, modern operators are satisfied with a clean and simple incision, when they have decided to treat hypopyon by paracentesis. This would be in fact the best method in such cases, if any operation be necessary, or if we are to believe M. Gierl on this subject. But the great masters of the present time unite in condemning all species of surgical interference; saying, with reason, that the small quantity of pus which forms hypopyon will disappear quite soon of itself when the ophthalmia is reduced; that a way to augment the secretion and produce opacity of the cornea, is to open the anterior chamber with an instrument of any kind; that the chronic purulent deposites—the only ones perhaps that paracentesis does not aggravate—are formed of a matter too firmly adherent either to the iris or the cornea to be made to escape by an incision of some lines in extent; that we should trust to general treatment and collyria to arrest such disease while it is yet within the bounds of true hypopyon, while there are yet hopes of preserving the function of vision. For these reasons I think, with Boyer, Richerand, and Dupuytren, that the puncture of the eye is but rarely applicable to abscess of the anterior chamber, unless we employ it, like Lehoc, to renew the aqueous humor as well as to evacuate the purulent matter.

4. *Empyesis.*—In abscess of the posterior chamber, that is, in *empyesis* or empyema of the eye, it would seem at first sight that all must agree upon the necessity of having recourse to paracentesis. But this would be a mistake. Many have advised it. Almost all the surgeons of the last century practised it frequently. Yet it is in fact a feeble resource. By this means we can only imperfectly evacuate the morbid collection. As it is soon reproduced, the evil is hardly removed for a few moments. The eye once in that condition is lost without resource. Incision is of no greater advantage. It is necessary to excise a portion sufficiently large to empty the eye and determine atrophy of that organ. The seton used in China and Japan, extolled by Woolhouse, and lately again brought forward by Mr. Ford, &c., is a barbarous means unworthy of criticism. It can scarcely be conceived how it could enter the mind of any man to traverse the anterior or posterior chamber from the external to the internal angle, with a needle drawing after it a cord which is to be tied by its two ends in front of the eye, to cause the escape or the dissipation of the empyema. The dangers and uselessness of such a proceeding are too evident to need pointing out.

§ 6. *Recision.*

Staphyloma of the cornea, empyema, hypopyon, and hydrophthalmia, are almost the only diseases requiring excision of the anterior portion of the eye, or for which it can be reasonably tried.

Its object is to empty the organ, to produce atrophy, and thereby transform it into a simple stump capable of supporting an artificial eye. It is the last resort, only permitted in a hopeless case to remedy a most serious disease or a shocking deformity, and only when it is demonstrated that sight can neither be preserved nor restored. In hypopyon, empyesis, and hydrophthalmia, it is to be resorted to only after trial of incision or puncture, and when these have proved insufficient. The most ancient authors used it in procidentia oculi. Galen speaks of it as a common method. Aetius recommends it to be combined with ligature; and that before removing the staphyloma two ligatures should be passed through it. The ligature may be circular, crucial, or transverse, like that of Paul of Egina, and others; the taxis and compression of Manget, and the crucial incision of Woolhouse, are none of them now in use. The surgeons of the present day, when they wish to obtain a perfect cure of staphyloma of the cornea, follow the advice of Pare and Louis, that is to practice a clean and simple incision.

Operation.—For whatever disease it may be, if we object to taking away the whole organ, we should confine ourselves to removing the summit. Cancerous affections, if they ever admit of a simple recision, form the only exception to this rule. By carrying the plane of the incision through the posterior chamber, as some oculists have done, the muscles are apt to draw what is left of the sclerotica and optic nerve to the bottom of the orbit, leaving us without a stump after recovery. On the other hand, if the opening be too small, the morbid or natural humors only partially escape; the wound soon cicatrizes, and leaves a depression as unsightly perhaps as the staphyloma itself, besides rendering it difficult to use an artificial eye. We escape these two extremes by taking the whole of the cornea, and nothing more. Then we are sure that the vitreous humor will escape or disappear, and that no new accumulation producing painful distension will be formed in the posterior chamber. The iris being preserved, it is evident that the sclerotica cannot become everted nor sink into the orbital cavity; and that after cicatrization the muscles can impress upon the organ the most of its natural movements, and transmit them to the artificial eye. The crucial incision with excision of the four flaps, as recommended by Richter, is altogether useless. The patient being suitably placed and supported, the inferior half of the cornea is to be divided with Daviel's instrument, the point of a lancet, a bistoury, or ceratotome of any kind, as if for extraction of the lens. The flap is then seized with any good forceps, and fully detached by means of sharp scissors or a bistoury. With unmanageable subjects, or when the eye is difficult to fix, a hook fastened into the middle of the segment renders the excision more sure and prompt. This process is more simple than that of Terras, who passed a ligature through the tumor in order to cut it off more easily and permit us to remove as rapidly as possible, and with a single stroke of a bistoury, the whole of the cornea or staphyloma; beginning either above or below. The ring and blade of M. Demours is not more convenient and deserves no preference.

The consequences of this operation are commonly active inflammation of all the parts within the orbit, fever, headache, and sometimes even some symptoms of a much higher grade. In general, however, after about ten or fifteen days, the swelling begins to decrease; the suppuration, at first very abundant, does not last long, and towards the end of a month, a little sooner or a little later, it is possible to put in the artificial eye. As this is not an operation without danger, those who desire it to be performed for simple deformity should be informed of its nature; nor should it be performed in such cases except at their solicitation. But on the contrary, when the disease is dangerous of itself, such as empyema, hydrophthalmia, &c., there is no room for hesitation; every fear must disappear in the presence of such affections.

§ 7. *Extirpation.*

Although extirpation of the eye was not clearly described until towards the close of the last century, there is every reason to believe that the older surgeons had frequent recourse to it: thus J. Lange, who wrote in 1555, boasts of having preserved an eye which surgeons wished to extirpate. A little later, in 1583, M. Donat attempted to demonstrate its inutility, and maintained that compression, aided by proper internal remedies, almost always triumphed over such affections as seemed to require it; which proves at least that it had been long known to practitioners. Bartisch, who published his book in 1583, has not then the merit of its invention, but only of calling attention to it and rendering the operation more easy. Some authors, Covillard, Lamswerde, and Spigel for example, pretend to have cured without an operation subjects whose eyes had been violently forced from the orbit and hung upon the cheek. Maitre-Jean long since showed the impossibility of such an occurrence according to the letter; but Louis has well remarked, that disrobing these assertions of their hyperbole, some proof in their favor is found in the fact that the optic nerve and the surrounding muscles can bear considerable elongation without requiring the extirpation of the eye. Besides, there are numerous examples of this elongation produced in a gradual manner by some cases of exostosis, by tumors of all kinds in the orbit, nasal fossæ, and maxillary sinuses. But if the eye really hangs out from the orbit in consequence of some traumatic lesion, instead of seeking to replace it we should completely separate and remove it at once. In such cases there is no method to describe. A single cut with the scissors or bistoury is sometimes sufficient; in others the surgeon must necessarily vary the process to suit the accident. On the contrary, when the eye has been forced from the orbit by degrees, either entirely or partially, and whether it be itself disorganized or not, it may be wrong to extirpate it. It is not to it that we must apply our surgical means. It is the business of the surgeon to destroy the original cause if he can, and then the displaced organ will soon return to its natural position. It was thus that St. Yves triumphed over a dangerous exophthalmia, by determining the resolution of a scirrhus formed in the depths of the orbit. It was by this means that the surgeon Brossaut, of whom Louis speaks, saw the sight of an eye restored and the eye returned into its cavity, after the oxostosis of the ethmoid bone, which had forced it out, had been destroyed; by this course Guerin, of Bordeaux, and M. Dupuytren, have arrived at the same result, removing or

emptying the various cysts or tumors of which the parts about the eye are so often the seat. Its extirpation then is not necessary for buphthalmia, for hydrophthalmia, empyesis, or staphyloma. Only cancerous affections admit of a resort to it. And it yet remains to be decided after the existence of these is proved, whether the operation is to be attempted. Those who think affirmatively, with Desault, &c., found their opinion upon the fact that the disease is observed on infants and young persons much more frequently than upon adults, and that at that age it is much more likely to be reproduced than after puberty. Their opponents adduce the researches of Wardrop, which go to prove that *fungus hematodes*—a mixture of the encephaloid, erectile colloide, and melaric tissues, or one of them alone, almost always constitute the disease. And as there is nothing which reproduces itself either in the same or some other place with more obstinacy than this kind of abnormal tissue, they maintain that the operation gives useless pain, and that nothing should be tried but simple palliatives. That which reason and analogy has taught them to expect, experience has but too fully verified. Whatever some authors may say, the labors of the ancients as well as those of the moderns, prove that extirpation of the cancerous eye does not render it less liable to return than the removal of a similar disease from any other part. I would not conclude however that it is right to remain inactive. So far from it, that I think the operation should be urged before the viscera have had time to become invaded by the morbific germs; as soon as the disease is no longer doubtful, and when it appears possible to remove it completely. All this, however, enters into the general question, whether or not it be proper to operate.

Operation.—1. *Process of Bartisch.*—The extirpation of the eye, which is much more frightful than difficult, more alarming for its consequences than fraught with immediate dangers or delicate of execution, may be performed in various ways. We find no details upon this subject in authors before Bartisch, who dug out the diseased part with a kind of cutting spoon. Although no person at this day could recommend so coarse an instrument, yet it is not true, as was once said, that it is apt to injure the bone and render the operation much more difficult than with any other knife. Its dimensions do not permit it to reach the bottom of the orbit, but I cannot perceive that it is often necessary to go so deep. To be just, it should be discarded merely as useless or not very convenient.

2. *F. de Hilden*, who had occasion to extirpate the eyé, in 1596, conceived the idea of embracing the projecting part at first in a kind of purse with a draw-string. Detaching the tumor from the lids and neighboring parts with a bistoury, he used for dividing the muscles and optic nerve a sort of two-edged scalpel, curved sideways, broad, short, and blunt at its point, or terminated with a button. We see in these proceedings the beginnings of a more enlightened surgery; and the operator spoken of by Bartholin was truly unpardonable in not profiting by them fifty years afterwards, nor recoiling at the thought of seizing the eye with pincers. Although more ingenious, Hilden's instrument has yet submitted to the fate of Bartisch's. While Job a Meckren succeeded with the spoon of the oculist of Dresden, and Muys and Leclerc with the knife of Hilden, Lavauguyon maintained that a good lancet fixed upon a handle was always sufficient, and might be substituted for them both. Saint Yves used only a thread to fix the diseased mass and one cutting

instrument, which he does not describe, for the whole operation. The observations of Bidloe make no mention of any particular knife, except a long bistoury bent at an angle near the handle, and which is much extolled by V. D. Maas.

3. *Heister* has shown us that a hook or forceps, and an ordinary bistoury, with which Hoin, of Dijon, was contented in 1737, are sufficient for this operation.

4. Such was the state of things when *Louis* undertook to fix the principles for extirpation of the eye. According to him, when the tumor is retained by nothing but the straight muscles and the optic nerve, we should use a pair of scissors curved sideways; these are to be carried to the bottom of the orbit to divide the musculo-nervous attachment, and serve as a spoon or scoop to remove the whole mass.

Desault, who in the earlier years of his practice adopted the method of Louis, afterwards abandoned the scissors as useless, and held to the simple bistoury only, with which he could effect more than with the curved one of B. Bell. Sabatier, Messrs. Boyer, Richerand, Dupuytren, and all the operators of the present time, conform to the advice of Louis or Desault almost indifferently. With the bistoury there is no necessity of changing the instrument from beginning to end of the operation. The division of the soft parts is neater. It is sufficient to draw the eye in one direction whilst cutting in the other to reach easily the posterior part of the eye. One must be very unfortunate or unskillful to carry the point of the instrument into the optic foramen, the maxillary or spheroidal fissures. It is therefore here, as we have already so often seen, a matter of choice or of circumstance, and not of necessity.

First Stage.—The patient might be seated on a chair, but it is much better to operate upon him in bed, taking care to have the head well elevated. The surgeon places himself on the same side with the affected eye, and conducts himself in different ways, according as the neighboring parts are or are not invaded by the cancer. If they are, he is to conform to the precept of Guerin, making two semilunar incisions, which enable him to circumscribe the base of the orbit and detach the lids so as to remove them with the rest of the disease. But if otherwise, he must exert himself to preserve the appendages of the eye. If they have contracted adhesion without suffering any real degeneration, he must dissect each lid away and turn it outwards. When the globe is thus freed from them, it is sufficient to extend the external palpebral angle about an inch towards the temple with a stroke of the bistoury, as appears to have been first advised by Acrel, and not by Desault. Throughout the whole our assistant holds the head of the patient so as to follow and favor the movements of the operator. The latter fixes the projecting part of the tumor with his hand if he can, as Desault did; or uses a hook with a single or double crotchet, hooked forceps, such as Museux's, or the purse of Hilden, or better still, as prescribed by St. Yves, a strong ligature passed by means of a needle through the degenerated mass.

Second Stage.—Holding the bistoury in the right hand like a pen, the operator carries the point of it to the greater angle, sinks in, grazing the ethmoid bone, to the neighborhood of the optic foramen, and then passes it flatwise over the whole inferior semi-circumference of the orbit, separating the attachments of the lesser oblique muscle, the oculo-palpebral fold of the conjunctiva, and

some cellulo-adipose filaments; then commencing again at the internal or nasal extremity of the wound, with the edge of the instrument upwards, divides the greater oblique muscle, and endeavors to remove with the same stroke the lachrymal gland; when, having traversed the roof of the orbit, he approaches the temple and is about to unite the two incisions at their outer extremity.

Third Stage.—Thenceforth the eye is held in its cavity only by the four straight muscles and the optic nerve, forming a pedicle. If the scissors be preferred for dividing this, the operator glides them on the internal rather than the external side, with their concavity towards the globe, as deeply as possible, and with one cut separates the cancer. If any attachments still retain it, they are rapidly divided in the same way, whilst suitable tractions are applied with the other hand. When the surgeon prefers the bistoury to the scissors, he should also select the inner side for its passage. On this side, the orbitary walls being nearly straight, it is easy, by inclining the point of the instrument outwards, to cross and cut the pedicle. But I must state, that with the bistoury as well as with the scissors it is not much more difficult to accomplish the end by following the temporal wall of the orbit. This was the route that Desault generally took, saying it was the shortest and most convenient. A motive more worthy of attention is, that by this we are more sure of escaping the maxillary and sphenoidal fissures. Whether the lachrymal gland be cancerous or not, it is necessary, if it have not been removed before, to seize it immediately after the operation by a hook or forceps and dissect it out. The secretion of tears being no longer needed would only be injurious. The surgeon then assures himself, by passing the finger into the orbit, of the state of the remaining parts; and if there be any unsound he should remove or destroy them either with the bistoury, the scissors, or the scraper.

Dressing.—No large artery should have been wounded. Those that are divided come from the ophthalmic. The ligature is not necessary even when they bleed freely. Pledgets of lint, clean or powdered with rosin, applied with more or less pressure, are sufficient to arrest it. The sponge proposed by some operators in place of this substance, would have the inconvenience of pressing the tissues too much by swelling in the midst of a solid cavity. The little bag filled with some emollient cataplasm, as recommended by Mr. Travers, who insists upon refraining from the slightest pressure, does not appear to be of any real advantage. At the end of four or five days suppuration is established. The lint is then easily removed. Nothing prevents us, if it is thought proper, from rendering the removal of the first dressings still more simple by covering the hollow of the wound with a piece of fine linen cut in holes and covered with cerate, which serves as a sack for the lint, and which, when the lids have been removed, is easily turned over upon the periphery of the orbit. A soft pledget large enough to support the deeper dressings, a pretty long compress laid obliquely, and the monocular bandage complete the dressing, which any surgeon may modify to meet circumstances. After the first removal, which may take place from the third to the sixth day, the dressing has no further peculiarity. The wound, after being washed with warm water and softly dried, must be dressed every time with a little dry lint. The lids slightly raised and protected by small fillets smeared with cerate, are covered again by a soft pledget and a compress. The whole is kept in place by a

monocular or some other appropriate bandage. The cure is commonly completed between the third and tenth week.

Remarks.—Although the preservation of the eye-lids renders the deformity less shocking, it is better to sacrifice them than to leave the least vestige of the disease. The incision of their external angle renders the rest of the operation easier, and produces no particular ill effect. A single stitch or a strip of adhesive plaster, will secure reunion. If the operation is commenced by the superior incision, the blood must somewhat embarrass the operator in cutting below. When the eye only is affected it is not necessary to carry the instrument more than an inch deep. But it is necessary to go to the apex of the orbit when morbid adhesions have been formed between the soft parts and the bone. Then the spoon of Bartisch, the knife of Hilden, and the bistoury of Bidloe will expose us to fractures, which it is always best to avoid. At this point, too, any sharp instrument used without great caution may penetrate through the frontal bone into the brain, especially if to reach the levator muscle or the lachrymal gland we elevate the point too much; enter the maxillary sinus and divide the infra-orbital nerve or vessels, if we carry it too far in the opposite direction; penetrate into the nasal within; the zygomatic or pterygo-maxillary fossa behind and without, and reach the second branch of the trigeminus nerve, or the internal maxillary artery; or into the cranium again by the sphenoidal hole, and touch the middle lobe of the brain. Yet if the bistoury should not scrape the bone it will not be sure to remove the whole of the cancer, but may require a subsequent excision. The lachrymal gland particularly, being almost entirely hid behind the external orbital process, is not easily removed with the eye. The scraper of Bichat, or a chemical caustic, will be less dangerous than the actual cautery, if either of them be indispensable for the removal of the soft parts; at least in the roof of the orbit. In fact, the proximity of the brain would render the use of the actual cautery very dangerous. Although it be the common practice to use the same hand for both incisions, it would seem more convenient on the right eye for example, to use the right hand for the lower, and the left for the upper incision, unless the latter be carried from the temple towards the nose. The levator palpebræ muscle should be cut; because, if left it tends continually to draw the upper lid inwards after the cure, thereby augmenting the necessary deformity. I had almost forgotten to say that M. Dupuytren begins with the superior incision, and finishes by detaching the organ from the apex towards the base of the orbit.

Artificial Eyes.—Nothing would be more desirable certainly than to be able to use an enamel eye, when the disease enables us to retain the lids in their integrity; but we should not flatter ourselves too much with such hopes. The orbit, like all natural cavities, once emptied contracts upon itself; its walls approach each other from the bottom towards the exterior; the circumference lessens, so that after a certain time the vault becomes completely effaced with this coarctation and the deposition of fibro-cartilaginous matter. Obliged to follow, the eye-lids contract adhesions by their posterior face, are deformed, and become most frequently incapable of applying themselves to the artificial organ which we would place behind them. Consequently, whether the lids be removed or not, we must expect to be forced, if the patient

desires to hide his mutilation, to use spectacles, skillfully furnished with a colored plate of metal to be fixed over the obliterated cavity. In former times they bestowed more pains upon them than we do. They had two kinds of artificial eyes: one like ours, to be placed behind the lids; the other, used from the time of Pare, who is said to have been the first to speak of it, a kind of convex plate, on which the anterior part of the eye and its appendages were painted, and which was held in place by means of a spring. Formerly the first were made of gold or silver; now enamel is justly preferred. Upon this must be represented the cornea, iris, pupil, sclerotica, and the vessels. In order to apply it, take it by the extremities of its greater diameter between the thumb and first finger, and carry it to the edge of the superior lid, which is gently raised with the other hand. It enters then as it were of itself, when the lower lid is depressed. In order to remove it at night on going to bed, the patient slips under it the head of a pin, draws down the inferior lid, and pulls it forwards. It should be deposited in a glass of water for the night, and be cleansed and dried carefully every morning before being replaced. I need not say that its dimensions should be adapted to the orbit of the particular individual, and that it is better to renew it whenever it begins to change. When the enamel is good, and the two posterior thirds of the natural eye remain to constitute a stump, the resemblance is sometimes so striking that it produces a complete illusion. In the other case, as there is nothing to move it, it remains permanently fixed in the centre of the eye, and unhappily it does not prevent us from distinguishing those who are obliged to use them.

SECTION III.

The Mouth.

Art. 1.—*The Lips*

§ 1. *Hare-lip.*

The labial fissure known by the name of hare-lip, is either acquired or congenital. When it occurs after birth, it is observed as frequently on one lip as on the other; but the second variety has scarcely been seen except upon the upper. The case of Nicati, who professes to have met with it on the lower lip, is certainly an exception. Since Louis interested himself in proving that the hare-lip is not attended with any loss of substance, Blumenbach, Tenon, Beclard, Meckel, &c., have attempted to explain its formation by certain laws of organization, considering its several grades as a cessation of development. At first, according to some, three portions compose the upper lip, a middle and two lateral. There might even be four according to others, who make the middle portion originally divided into two parts. In this hypothesis one of the embryo fissures of the lip is supposed to remain in the case of simple hare-lip; and the proof they say is, that it is almost constantly found on the median line. When the two lateral portions remain isolated from the middle portion, the hare-lip is necessarily double. If the authors of some observations already ancient, and more recently Moscati, are not mistaken; if they have really seen the leporine fissure in an exact line with the septum

of the nose, this may be explained by admitting the non-union of the two portions of the middle lobe of the lip. Lastly, as to the lower lip, a congenital hare-lip will always occupy the median line, because in its origin there are never more than two portions. Numerous researches upon embryos and fœtuses of every age, induce me to believe that these inaccurate ideas are the result of erroneous observations or gratuitous suppositions. The lips are no more composed of two, three, or four pieces, at three, four, six, or eight weeks than at three or four months. From the moment they begin to appear they seem as entire as the buccal opening which they exactly bound. The contrary only occurs accidentally. The hare-lip, like most other monstrosities, ought in my opinion to be referred to disease much more frequently than to a defect of natural development.

CHEILORAPHY.

A. *Simple Hare-lip.*

a. History.—Although the hare-lip is one of the most common deformities of infancy, it scarcely occupied the attention of the ancients. Celsus is the first who mentions it, and he rather confusedly. The Arabians scarcely notice it, and it is clear that until the times of Franco and Pare its treatment did not attract all the attention that it deserved. At present, on the contrary, it forms a part of practice to which nothing further seems wanting. For its cure three indications are to be fulfilled. The edges are to be made raw, its two sides are to be brought evenly together, and the two lips of the division are to be kept in perfect contact until they have become agglutinated.

1st. It was with hot iron, that Abul-Kasem, as well as Ludovic, produced the state of rawness in the hare-lip. The *butter of antimony* or some other caustic was preferred by Thevenin. Chopart, yielding in this to the advice of Louis, expected to succeed better by applying two vesicatory strips to the edges of the fissure. Such means only deserved and actually met with but incomplete success. They have been justly abandoned. *Excision,* which has been in use from the time of Celsus and Rhazes (this, however, did not prevent Fabricius ab Aquapendente from confining himself to simple scarifications), is the only method admitted at the present day. In performing it, D. Scacchi and Dionis used common scissors; Henkel, button-pointed ones. But M. A. Severin and Acrel gave exclusive preference to the bistoury, which Louis and Percy have strongly endeavored to bring into general use; while Roonhuysen, Le Dran, and B. Bell, had recourse indifferently to either of these two instruments. The advocates of the bistoury contend that it produces less pain, and makes a wound much neater and less inclined to suppurate; that the scissors cut more by pressure than actual incision; that they bruise the tissues and produce a wound of two oblique planes like a double roof, by no means favorable, from its shape, to immediate union. Experience has a thousand times demonstrated the futility of these objections. To be assured on this point, Bell operated on one side with the scissors and on the other with the bistoury, without explaining his intention. The patient was at first embarrassed, in deciding, but at last declared that the pain was greater in the part where the bistoury had been employed. The scissors have an advantage, in requiring no support, in being more easily managed, and in

cutting off at one stroke all that is to be taken away. Desault, who has strongly advocated them, recommends them to be made of considerable thickness and much hollowed in the blades. Those which are now preferred bear the name of M. Dubois, and are constructed on this principle. For the purpose of giving greater advantage to the power which moves them, the handles are made comparatively long; the blades are short and solid, and thus cut with great neatness and all desirable precision. This is the only instrument used in France.

Nevertheless, it would be wrong to conclude that the bistoury is not sufficient. Louis has afforded proof enough to the contrary, and many practitioners of Germany and England are still in the constant habit of employing it. The manner of using it, has singularly varied. At the instance of Guillemeau, Le Dran commenced by inserting its point, from the mouth towards the skin, through the lip a little above the summit of the division; he then cut perpendicularly from above downwards, or from behind forwards as far as the labial border; and did the same on the opposite side. B. Bell reversed this process. Placing himself behind his patient's head, he began his incision at the free edge of the lip, carrying it upwards and backwards to a point above the abnormal fissure, holding his bistoury as a pen. Enaux, after destroying the adhesion between the alveolar arch and the lip, passed behind the lip a plate of cork to give support to the action of the bistoury. A fold of paper, a common playing-card, or a thin piece of white wood, will very well supply the place of the bit of cork of Enaux. The forceps or pincers, whether of metal like those of J. Fabricius, or of wood like those used by M. A. Severin, which serve to fix the lip while the section is being made, and which by the greater breadth of their posterior branch were able to supply the place of the pasteboard required in the use of the bistoury, and the intention of which was also to aid in the approximation of the two cut borders and prevent hemorrhage, have long since been rejected from practice. Heister, B. Bell, and O. Acrel, are, I believe, the latest authors who have thought proper to recommend them.

2d. After the borders are made raw, the hare-lip is found reduced to the state of a simple wound, and its union is to be immediately attempted by the aid of appropriate bandages or the suture, or by combining both these means. Franco, who was satisfied with the plasters of Andre de Lacroix fixed upon the cheeks and narrow ribands crossed beneath the nose constituting what he termed the dry suture, and then a retaining bandange; F. Sylvius, who, according to Muys, succeeded with adhesive strips alone, supported also by a bandage; Purman and G. W. Wedel, who it is said were not less successful; have found in Pibrac, but particularly in Louis, an ardent defender. According to this author, the bloody suture is not only useless but even injurious. Useless, inasmuch as the hare-lip being unattended with any loss of substance, must always be susceptible of approximation by the uniting bandage of rectilinear wounds; injurious, for its presence is a permanent cause of irritation, which cannot fail to excite muscular retraction. In accordance with this principle, Louis employed a single point of interrupted suture, and a simple bandage to complete the union. The ideas of Pibrac, who wished in some measure to proscribe the suture from surgery, seemed to find here a just application. To produce a complete coaptation Valentine invented a clasp, a kind of double flat forceps, capable of embracing the two sides of the wound without destroying their

parallelism, and of being approximated at pleasure by means of a transverse piece and a screw. To prevent the contusion and the unequal compression which the instrument of Valentine was apt to produce, Enaux proposed a bandage, the model of which is still preserved in the museum of the Faculty of Paris, and which being applied over the nape of the neck, the vertex, and beneath the lower jaw, by as many segments of circles, presents two cushions which are to push forward the parts when applied to the cheeks, and may be united by passing a strip in front of the wound from one to the other. Evers rejected all these means, and confined himself to emplastic strips, crossed beneath the nose in the form of St. Andrew's cross; and M. Dudan has since invented with the same view a new clasp, founded on the same principle with that of Valentine. No doubt the hare-lip is sometimes cured in this manner; but it is also certain that more frequently the union is bad and incomplete; that there often remains a groove of more or less depth either in front or behind; and a gap is left quite open below, almost as disagreeable as the original disease: while the bloody suture, properly performed, avoids all these disadvantages. On this account it is almost exclusively practised in our day, and bandages are no longer advised but as auxiliaries.

Celsus, who sewed the hare-lip, does not give details enough to let us understand what was the kind of suture employed in his time. It is probable from what is said of it by Albucasis, that the Arabians used the *glover's* suture. Others, Heuermann, Ollenroth, and W. Dros, for example, have advised the interrupted suture, which was also preferred by Lassus, in order to avoid leaving inflexible bodies in the wound. There is none, even to the quilted suture, which has not had its partisans, although the twisted suture has almost always maintained the preference. Ambrose Pare, the first author who describes it in precise terms, performed it by means of needles furnished with eyes, which he carried through the wound from one side to the other, and then fixed by turns of thread, passed in the form of the figure 8, over the two extremities. Fabricius ab Aquapendente used flexible needles, the extremities of which he bent forwards after their insertion. Those of Roonhuysen were angular or triangular, like those of Pare; he wound them with silken thread, and cut off their points with nippers. Dionis used them of steel, and curved. Instead of taking off their points, like Roonhuysen and Dionis, La Charriere merely placed a small compress between their extremities and the skin. For the purpose of introducing them without trouble, notwithstanding their fineness, Heister made use of a porte-aiguille; and J. L. Petit, who used them stronger, and furnished the two extremities of each with a head, caused them to be made of silver, which he introduced by means of an instrument resembling a larding-pin. Le Dran employed gold pins, so that they might be at the same time solid and strong and not liable to be oxydized; their points were flattened and they were furnished with a head in order to dispense with the porte-aiguille. If gold and silver have the advantage of not rusting, they have the disadvantage when used in cutting instruments of not passing through the tissue with facility. For this reason Sharp soldered to his silver needle a lance-shaped point of steel. Wedel contends that common needles will serve, and should be wound afterwards with a hempen thread. Without so much preparation, de la Faye asserts that copper pins stout and long, in a word, German pins, are better than all others. As their points might wound the patient, Mursinna recommends that they should be guarded afterwards

with small pieces of quill. Le Dran found it more convenient to use small balls of wax. Arnemann employed hollow pins from which the head and point could be removed at pleasure. Desault's, which are of silver with steel points, diminish in size from their cutting extremity to that which is to support the action of the finger, in order that they may be extracted without repassing them by the same way that they entered, and without again drawing the blades through the flesh. It is this kind that, in France at least, has united almost every suffrage. Indeed we see no reason to object to them; except that good common pins, such as are to be found everywhere, will answer the purpose equally well, if, before inserting them, care be taken to grind them so as to flatten the point by rubbing them on a tile or stone vase, or any other piece of stone.

As to the *semilunar incisions* with their concavity anteriorly, which Celsus performed on the interior of the cheek, and which Guillemeau, Thevenin, and Manget performed on the exterior; the dissection of the posterior face of the lip, which J. Fabricius and D. Scacchi have pointed out as favoring the approximation of the borders of the hare-lip; they should be no longer mentioned in simple cases, unless to show their absurdity and barbarity. It is not so, however, with the idea of preparing the parts beforehand for approximation. Instead of the forceps of Fabricius, &c., V. D. Haar, and after him Arnemann, and Knackstedt of St. Petersburg, have proposed a bandage, which being worn for a week or two is capable of bringing towards the median line those points the ultimate contact of which is to be effected. It is rare, nevertheless, that the moderns feel obliged to follow this indication, knowing that the common uniting bandage will attain exactly the same end. Unless the separation be extreme, the immediate coaptation of the sides of the wound presents in general but very few difficulties.

Apprehensive that, notwithstanding the suture, the parts might afterwards retract, surgeons of different times have labored to find means to obviate this inconvenience. Hence the load of apparatus with which the science is overburdened, and the association of the dry suture or bandages with the bloody suture. On this point Dionis seems to have set the example. He placed an adhesive plaster upon his twisted needles and supported the whole by a four-tailed bandage. By means of a circle of steel which passed round the head, and graduated compresses which he fixed upon the cheeks, La Charriere considered success infallible. As substitutes for his bandages as it was afterwards modified by Quesnay, Heister, Henkel, Kœnig, Stuckelberger, Eckholdt, &c., Enaux, Valentine, and Beind constructed those which bear their names, but which have entirely yielded to the bandages of Louis and Desault. Without being indispensable, the retaining bandage, such as is generally used among practitioners of the present day, has the undoubted advantage of protecting and aiding the action of the needles, and of rendering disunion of the parts much more difficult in unmanageable subjects. When we dispense with it, like the ancients, or, like Le Dran, limit ourselves to the use of a strip of adhesive plaster, extending from one temple to the other, and running beneath the nose in the way that English practitioners, with Beclard, &c., still prefer, its inutility is its only fault; for how it can be injurious does not appear.

b. Operative Process.—The following is the mode of performing this ope-

ration: The apparatus consists of a hook; a pair of dressing or dissecting forceps; a pair of hare-lip scissors; three, four, or six prepared needles; a single waxed thread two or three feet long; another thread of three or four strands and twice as long as the first; small rolls of diachylon or linen to place on the extremities of the needles; a small pledget of lint spread with cerate; two compresses a little longer than broad, and folded six or eight times, to be applied to the cheeks; a double-headed roller an inch wide, and long enough to make four or five turns of the head; a sling or four-tailed bandage; adhesive strips in case the bandage is not to be employed; and a playing card and a straight bistoury if the scissors are not to be used.

First Step.—The patient being placed on a chair in a good light, has his head held firmly by an assistant in such a manner as to enable him at the same time to compress the external maxillary arteries beneath and in front of the masseters, to push forward the cheeks towards the median line, and hold the lip, if necessary, while the operator makes his incision. A second assistant is charged with handing the several parts of the apparatus as they may be required. Seated or standing before the patient, the surgeon passes a thread through the left inferior angle of the division, as advised by Kœnig, unless he prefer inserting a pin or holding it with a hook, as practised by M. Roux, or merely to use the pincers or the fore-finger and thumb of the left hand to fix it. The scissors, held in the other hand, are then carried two or three lines higher than the superior angle of the fissure, separating all the rounded portion at a single stroke if possible, and encroaching even a little on the sound parts so as to make a wound fresh, straight, regular, and perpendicular. On the other side he stretches the lip itself, by seizing and drawing it with the thumb and fore-finger placed without the border to be excised. The scissors, guided as before, are to be raised with their point as high as the superior extremity of the first wound, and even a little higher, in order that the two little strips which are to be insulated, and which by their union represent an inverted V, may be immediately freed from all adhesion up to their nasal angle. Nevertheless, if at this point a pedicle should remain, all endeavor should be made to leave it of the least possible thickness, and with a third stroke to cut it as high as possible; otherwise this part of the wound being too round, will only with difficulty admit of exact coaptation.

Second Step.—To make the suture, the operator again takes hold of the right angle of the division with the fore-finger and thumb of the left hand, and with the right carries the point of the first needle to a point on the skin half a line above the red border of the lip, and three lines outwards from the raw edge; he then enters it a little obliquely from below upwards, from before backwards, and from the skin towards the mouth, so that passing through the tissues it may come out at the union of the anterior two-thirds with the posterior third of the bloody part; then changing its direction, he pushes it through the other lip from behind forwards, and from within outwards, so that its entrance and its exit may be on as exact a level as possible, and that in its whole course it may describe a slight curve, the convexity of which will look a little backwards and upwards. Its two extremities are then included within a noose of the single thread prepared for this purpose, which allows the assistant in charge to stretch properly the whole extent of the lip while the surgeon fixes the second needle. This, which is usually the last, is to be

inserted at an equal distance between the first and the superior angle of the hare-lip. It is not necessary, as with the first, to make it describe a curve, nor to carry it separately through the two parts of the division. It is pushed through transversely with the right hand, while the fingers of the left preserve the two edges of the wound in exact coaptation; always taking care to enter it and bring it out of the skin at about three lines from the solution of continuity. It is embraced immediately after with the middle portion of the doubled thread, the operator using both hands. The two ends of the thread are then carried round in turns, crossed in the form of the figure 8; afterwards brought back, forming an X, beneath the inferior needle, which is wound in the same manner; and thus in succession from one to the other, until the thread is exhausted or the whole of the wound concealed by the figures 8 and X which it has formed. In conclusion, the two ends are arranged so as to be brought under the head or point of the superior needle.

Third Step.—The first thread being no longer of use is cut by the surgeon, who then places between the integuments and the metallic ends little protecting rolls, or the pledget of lint, the fillet of diachylon, or the bandage if he mean to use it. In this case he applies the body of the bandage to the middle of the forehead; carries its two heads below the occiput; crosses them and changes hands; brings them back above the ears upon the square compresses which the assistant holds upon the masseter muscles; carries them to the sides of the nose; makes a slit in one of the heads of the bandage opposite the wound, through which to pass the other and cross them more easily; carries them behind above the nape of the neck, crosses them again, and finishes by circular turns round the head. The string, or four-tailed bandage, which is to fix the whole is first applied with its body to the chin. The two inferior ends are carried up in front of the ears, over the genal compresses as far as the vertex, where they are made fast. The two remaining ends are carried horizontally backwards, crossed at the occiput, and brought forwards on the forehead.

Subsequent Treatment.—This being done, the patient is put to bed, where he must rest quiet, without speaking or attempting the least motion of the jaws for three or four days. His diet must consist of broth, light soups very liquid, or some kind of ptisan. At the end of three days, if all goes well, the superior needle may be removed. On the fourth the inferior one may also be taken away. The coil of thread adhering to the skin being left in place a day or two, allows the cicatrix to become more and more consolidated. When it is disengaged from the front of the lip, it may be supplied by an adhesive strip if there be any fear that the union is not sufficiently firm. Towards the ninth or tenth day the cure is generally completed. After the fourth day there is no objection to soups a little more substantial, or to the patient's rising and walking about.

c. *Remarks.*—Before commencing the operation, it is almost always necessary to divide the frænum of the superior lip, which however is not attended with the least difficulty. It cannot be dispensed with if scissors are to be used, except in cases in which the fissure is of little depth and situated without the median line; nor does the bistoury admit of any exception on this point unless we dispense with the card. When this is employed, the frænum is divided and the card is placed as high as possible between the maxillary bone and the

lip. After fixing the left border of the hare-lip upon the card by holding it at its inferior angle, the point of the instrument, which is held as a pen, is carried to the part where the incision is to commence, where it is inserted perpendicularly, the handle gradually depressed, and a single stroke cuts through the whole length of the fleshy border contained between its edge and the card which prevents it from penetrating the mouth. To cut off the other border, the surgeon seizes the lip beyond the line of division, unless he can use his left hand sufficiently to perform with it what he has done on the other side with the right, carrying in every case the point of the bistoury to the superior angle of the first wound, and terminating the incision on this side as on the other. The compress which Lavauguyon placed between the lip and the gum *to prevent adhesions of this latter;* rejected as useless, or else as dangerous by Le Dran, proposed again by Heuermann, is not used at the present day; nor the plate of lead advised by Eckholdt for the same end. Cases in which the lip has been detached to a great extent from the maxillary bone, are the only ones which give an excuse for its application.

It is useless to apply so many as five needles, as recommended by Roonhuysen; two are generally sufficient; and it is not absolutely necessary that the superior one should be at the superior part of the wound, as advised by Le Dran. De la Faye and Mursinna, who direct to commence with the superior, no doubt forgot that the two labial extremities of the division are thus in danger of not being on a level. De la Faye himself was obliged to cut off afterwards the unsightly tubercle which resulted from this mode of operation in one of his patients. Without conforming entirely to the principle of Le Dran; without plunging the inferior needle in the vermilion border of the lip (a rent would almost inevitably be the consequence), yet it must be known, that at more than a line above, union might well prove incomplete and a little gap be left below. If it does not penetrate near the buccal surface of the organ, agglutination will only take place in front; a furrow or groove of more or less depth will remain behind, and render success very imperfect. The bleeding parts not being in contact, nor pressed upon equally through their whole thickness, may sometimes be the cause of hemorrhage. On the other hand it is easily perceived how troublesome it would be to pierce each half of the lip entirely through. In making the needle describe an arch, the object is to depress the tissues on the median line a little more than on the sides, in order to reproduce as much as possible the tubercle, the little projection which there naturally exists. Curved or flexible needles would be incapable of fulfilling this indication.

Although, as a general rule, it is necessary to cut off rather too much than too little, and to prolong the wound, according to B. Bell, nearly to the nose, yet it is sufficient, when the gap is of little depth, to take away all the red border and reduce the hare-lip to the state of a recent wound with loss of substance, exactly triangular, and with edges of the same thickness throughout. If the effusion of blood from the coronary artery, which is at first copious, will not yield to compression of the facial on the edge of the jaw, the assistant has but to compress the corresponding half of the lip to arrest it. The ligature is never indispensable here, nor the cautery. When the cut edges are brought together the hemorrhage ceases; a defect of contact in some point or other, or some unforeseen accident, will alone permit it to continue. For the rest,

the surgeon would be blamable not to have an eye on it during the first few hours following the operation, particularly in children. Indeed, instead of being rejected, the blood is swallowed by them as it flows imperceptibly into the mouth, and in this manner, Platner says hemorrhage remains unperceived, and may, according to examples cited by J. L. Petit and Bichat, go so far as to produce death. Before applying the bandage it is well to cover the head with a cotton cap, so fitted as not to be easily deranged; to have the head well combed, and, as practised by Desault, to rub in a little mercurial ointment to prevent the necessity of scratching, which young subjects could not resist if vermin were engendered in the head. The two compresses which are placed in front of the ears, have the triple advantage of pushing forward the tissues, of rendering the bandage more supportable, and of preventing the motion of the cheeks.

Instead of slitting one of the tails of the bandage through which to pass the other on a level with the wound, it might with propriety be crossed carefully beneath the nose. The important point is, that no wrinkles be made, and the pressure produced be equal and gentle. Louis cut the free extremity of his bandage into three strips from fifteen to eighteen inches in length, and also made three slits or button-holes nearly two feet farther, for the purpose of producing a crossing more even and firm over the solution of continuity. Desault, on the contrary, rolled his into a single head and fixed it by a circular turn around the head, and when he had brought it as far as the labial angle of one side by means of the genal compress, he drew forcibly towards him all the soft parts of the opposite side, which otherwise would have been liable to be forced backwards contrary to the intention of the operator. But, notwithstanding what is said by Bichat, the ordinary bandage avoids some of the disadvantages and preserves all the simplicity of Desault's.

The sling (four-tailed bandage) generally employed is a very useful auxiliary in some cases. By opposing the separation of the jaws, it favors the action of the suture. When it is recollected, that in a patient of Garengeot a burst of laughter sufficed to disunite the wound; that a lad operated upon by De la Faye met with the same accident, because some tobacco being rasped near caused him to sneeze; it may well be permitted to employ every means of preventing motion of the mouth. By not withdrawing the needles until the expiration of five or six days, as directed by Garengeot, after having taken away the thread, it is to be feared that the part may be transformed into an ulcer and the final cure retarded. If they are withdrawn the next day or the day following, as Le Dran assures us he has done without disadvantage, it is almost certain that union will not be preserved. Besides, as there has not yet been time for suppuration to be excited around them, their extraction can never take place without difficulty. In every case, when we are ready to withdraw them, it is proper to anoint with butter, oil, or cerate, the end which is to pass through the tissues, that is, the point in needles with heads and in others the blunt extremity. They must be drawn gently and steadily, turning them on their axis when they resist, and always giving support with the fore-finger of one hand to the corresponding side of the lip while the attempt is made to withdraw them. A little lint spread with cerate, and lotions of vegeto-mineral water are all that the subsequent cure of the punctures require.

B. *Complicated Hare-lip.—a.* In the double hare-lip, if the palatine vault does not partake of the deformity, two different conditions may exist. Sometimes the two fissures are separated only by a narrow and somewhat prominent tubercle, which must be included in the angle of union of the two incisions made in simple hare-lip. Sometimes, on the contrary, this tubercle is too large to admit of its being destroyed without disadvantage. Then, whether it descend or do not descend to a level with the border of the lips, it is better to cut off the two sides at the same time as the external edges of the double division which it separates. It is then perforated with all the needles in the first case; but in the second with only one or two of the uppermost, so as to fix it in the middle of the suture. This method, the most ancient of all, is at the same time the most simple, the most prompt, and the most certain. Yet if the middle portion be very large at its base, we may, having first caught its apex with one needle, carry through one or two others from each side, in a manner still followed by M. Gensoul. After the cure the cicatrix resembles a capital Y, and represents the passage of the naso-labial columns. The patient scarcely perceives that he has been made to undergo two operations instead of one. He is cured in as short a time, and subsequent inflammation is neither greater nor less than what occurs in simple hare-lip. Consequently, the idea held out by Louis or Heister of not operating at first but on one side and waiting its complete cicatrization before attempting the other, although followed since by some practitioners, neither has nor ever should have been adopted.

b. The deformity however is sometimes still more complex. *The portion of the maxillary bone* which supports the middle button, forms in some cases a considerable projection forwards. Thus constituted, whether coexistent or not with a double division of the palatine vault, the attention must be directed to it before passing to the rest of the operation. Franco at first, D. Ludovic, and afterwards Chopart and several of the moderns, have proposed to remove it after separating its soft parts with a small saw or bone-nippers, or a gouge and mallet. Desault having remarked that this excision would leave a vacancy behind the lip, which therefore would not find a proper point of support; that moreover there might result such a narrowing of the superior dental arch as in the end would bring it to lock within the inferior dental arch during mastication, of which he gives an example; conceived the idea of preserving the projection, and directed his efforts to force it back by applying for two or three weeks moderate pressure on the anterior face of the tubercle which it supports. This mode succeeded with him perfectly in several cases. Verdier and other surgeons have since obtained from it similar advantages. It ought consequently to be adopted in simple deviations of the teeth nearest the median line. To extract them, as suggested by Gerard, and as most modern operators recommend, is an extreme means, to which recourse should not be had until after having vainly tried to restore them to their position by pressure, or by drawing them within the mouth by means of wires fixed to the lateral teeth. To conclude, it is rare with judicious precautions and a little patience that we do not succeed in removing these osseous projections in young subjects without destruction of any part. Lassus has very well remarked, that if the teeth or the bone which contains them present in front no asperities or sharp angles, the operation will terminate successfully. Union

having once taken place, the pressure of the lip on the parts will be sufficient in the course of time to give them their proper place and direction. In some cases it would be advantageous to follow the method pursued by M. Gensoul, in the case of a young female in whom the intermaxillary projection, surmounted by the incisor teeth had become almost horizontal. After dissecting and turning back towards the nose the flap of the soft parts, and having removed the four incisors, this surgeon seized the prominent part of the bone with strong nippers as for the purpose of breaking it, and succeeded in giving it a perpendicular direction; he depressed in the same manner the right canine tooth; made raw the four borders of the double hare-lip; used the twisted suture, and supported the whole by a bandage. The young patient, thirteen years old, was perfectly cured. The incisive bone became consolidated, as well as the canine tooth, in the new position given to it; and its edge, which was on a level with the molar teeth, was sufficiently solid to serve as a point d'appui to the inferior incisors during mastication.

c. *The Simple Fissure of the Maxillary Arch*, or that in the shape of Y, to remedy which the old surgeons thought nothing should be attempted, and which therefore prevented them from conceiving the treatment of the hare-lip with which it is complicated, is no obstacle to the success of the operation; and in this regard, unless there is too wide a separation, does not require any special modification of the process. After the suture, its edges gradually approximate, and finally the fissure itself sometimes completely disappears; insomuch, that examples are already found in Roonhuysen, Sharp, De la Faye, Quaisnay, Richter, B. Bell, and Lapeyronie. In the case observed by Gerard, this fissure, which was not less than a finger's breadth, was closed at the end of two years. Several weeks were sufficient in a patient of Desault; and M. Roux mentions a child, three years old, in whom a similar separation scarcely left a trace at the end of the fifth month. The moderate but constant and regular pressure which the lip, whose continuity has just been established, exerts upon the external surface of the bone, is the only cause of this truly remarkable phenomenon. Nevertheless, if it is slow in effecting it, either in consequence of the long duration of the disorder or from the extent of the fissure, I do not see why we should not seek to favor it by compressing bandages, applied either below the malar bone upon the skin, as advised by Jourdain and Levret, and opposed by Richter; or immediately upon the alveolo-dental arches, as I myself performed in 1825, at the recommendation of M. Roux; or by covering the whole head with a bandage in the manner of the fillet of Dent, or the tape apparatus of Terras. Indeed there may be a thousand modes of accomplishing it; but the object once indicated, every one marks out for himself the course he will follow to fulfill it. As in these various cases the part finds posteriorly but a very uneven support, and as an artificial plate retained beneath its posterior surface would have the serious disadvantage of irritating the parts, the bandage should be so disposed as not to exercise a too powerful pressure in front. I need not add that the needles cannot be safely withdrawn until the fourth or fifth day.

C. *Age proper for the Operation.*—A final question remains to be considered: is it prudent to operate on the hare-lip during the first months of life, or is it not much better to wait till the age of reason? The latter opinion, supported by Dionis and the greater part of the surgeons of the eighteenth

century, is almost exclusively adopted among us at the present day. The reason advanced is, that the very young infant, being incapable of concurring in the precautions demanded by the operation, cries, agitates itself, and yields to all the energy of its motions the moment it is approached. The mere sight of the surgeon or of those around it during the cheiloraphy, is sufficient to excite its fears and render it unquiet. The slight consistence of the tissues and their liability to laceration, are causes why the points of the suture tear out upon the least traction. The tongue, accustomed to the habit of sucking, comes continually between the lips, and in some measure prevents union. Strict diet, which is rigidly enforced for some days, produces sometimes, according to Lassus, so rapid an emaciation, that at the end of twenty-four or forty-eight hours the cheeks of the child become flaccid, and every part of the suture greatly relaxed. Besides, it is scarcely of importance to the patient whether he is cured a little sooner or later, as long as he is unable to talk. After the first three or four years, the difficulty he meets with in expressing his thoughts, the raillery of his little play-fellows, and the consciousness of his own infirmity, naturally create in him a desire to be freed from this embarrassment. At this period, reasoning, entreaties, and threats have already acquired a certain empire over him. He is able to submit to the diet, and the density of the tissues is much increased.

To these views Busch of Strasburg, who, with Roonhuysen, Sharp, Le Dran, and Heister, adopted the opposite opinion, replies, that we may prevent the motion and cries of the patient by not permitting it to sleep for several days beforehand, and administering to it a preparation of opium shortly before the operation, in order that it may be quiet and fall asleep immediately after; that a child of three, six, or even ten years of age is often more difficult to manage than an infant at the breast; that altogether a stranger to fear, the latter only regards pain and real wants, whereas the former resists the idea of the least suffering, and in reality attaches but little value to the results of the operation which it is desired to perform on him; and though in the infant the tissues are more easily cut and torn, they are, on the other hand, better disposed to effect prompt agglutination. I will add, that when the suture is well performed the motions necessary for the ingestion of a few drops of milk or soup, oppose but a feeble obstacle to success. Besides, the hare-lip seldom permits the little patient to accustom itself to sucking. The prolonged existence of the evil entails more disadvantages than seem to be imagined. It impedes the development of the intellectual faculties by the difficulty it produces in the pronunciation, and consequently in the use of the ordinary means of education. When it is complicated with the palatine division, the longer we wait the more the bones separate for want of resistance from without. In this last case suction and deglutition itself may be rendered extremely difficult, and death from inanition become inevitable; examples of which have actually occurred. Besides, to the arguments of Lassus, Sabatier, M. Roux, &c., we may oppose the daily practice of English surgeons; the success obtained by Muys, Roonhuysen, Le Dran, Bell, and Busch, on infants, even a few days, a few weeks, or a few months old; and the three cases recently published by M. Delmas of Montpellier. For the rest, I would operate in the first months and as soon after birth as possible, unless I intended to wait the expiration of

early infancy. From the period of the second year the patient being more unmanageable is yet not much more reasonable, and the disadvantages of his situation, which are no longer of a nature to jeopard his existence, permit us to temporize for three or four years longer. Therefore I would select the first six months of life, or from the fifth to the tenth year, to perform the suture of the lips: that is, I would advise that patients who have not been operated upon in the first period should wait until the second. After all, if the borders of the division are so widely separated as to render it almost impossible to bring them in contact, it would without doubt be useless to attempt the suture. I saw it tried without success in 1822, at the hospital St. Louis, by M. J. Cloquet upon an infant about a month old, under these circumstances. But it is doubtful whether at a later period we might not succeed better. Why not begin in difficult cases by diminishing the opening with a good compressor, such as the spring, from which M. Pointe, of Lyons, and subsequently M. Maunoir, of Geneva, have found so much advantage? Why not separate from the bone the two divisions of the lip as far as the os malæ, so as to be enabled to bring them more easily towards each other; as appears to have been already advised by J. Fabricius, Horn, Nuck, Roonhuysen, &c.?

In whatever manner he intends to operate, the surgeon ought, before taking the instrument in his hand, to be deeply penetrated with the idea that, notwithstanding all its simplicity, the operation on the hare-lip requires skill and dexterity; that if he does not ever appreciate these according to their true value, he necessarily performs it badly, and in proportion to the honor it does him when he derives from it all possible success, so will it injure him when he succeeds but imperfectly.

§ 2. *Excision.*

Cancerous tumors and all cancerous degenerations are not more susceptible of cure upon the lips than elsewhere. Extirpation, when practicable, is almost the only remedy. It is doubtful whether caustics, still successfully employed it is said by M. Fleury of Clermont, Helmont, &c., may be substituted in its place. In another article it was my duty to point out the course to be pursued when the maxillary bone itself is affected; consequently I intend to speak here only of what concerns the soft parts. When the disease occupies but a small extent of the labial border, or when it runs more vertically than horizontally, the operation, as simple as it is easy, may be performed in two ways:

1st. The first consists in circumscribing the cancer by two oblique incisions within a triangular flap, a kind of V, of which the base shall correspond with the free border of the lip. The patient and assistant are placed as for the hare-lip. The surgeon seizes the morbid tubercle with the thumb and fore-finger of one hand, while with a pair of scissors or a bistoury in the other he describes his flap, taking care to cut in the sound parts, and to proceed from the buccal opening towards the point of the V, which he is to take away. The excision made, it only remains for him to bring together the edges of the wound which hereby results, to preserve it united by means of the suture, and to treat it as that of the hare-lip. This method, the only one followed for a long time, is as applicable to the superior as to the inferior lip, to the middle

portion as to the angles of the buccal opening, and is to be preferred as long as the loss of substance need not be considerable: for example, need not comprise more than the half of one of the lips.

2d. The other is apparently still more simple. It is reduced to a simple crescentic incision, including in its concavity all the unsound tissues; which is performed either with the bistoury, or with scissors curved in the flat; and which leaves behind it a furrow of greater or less depth. It is applicable only to the inferior lip, and when the affection extends more vertically than transversely. Some moderns have without cause claimed this idea. It was in application at the time of Le Dran. Louis quotes a patient who submitted to it, in whom it was said the lip was renewed. Camper gives it as his own contrivance. It is even found in Fabricius ab Aquapendente, who remarks very justly that a large portion of the lip may thus be removed while the deformity resulting from it is much less than might have been imagined. Whatever may be the case, it was almost entirely forgotten when Messrs. Richerand and Dupuytren raised it to consideration amongst us. Two circumstances concur in rendering easy the elevation of the lip towards the dental arch after the excision performed in this manner. These are the eccentric repulsion of the sound tissues caused by the development of the cancer, and the gradual tractions excited afterwards by the cicatrix upon the integuments of the chin or of the superior part of the neck. The fact is, that the surrounding soft parts in subjects who have thus lost the whole lip from one commissure to the other, have been seen to lift themselves up and converge sufficiently towards the mouth to cover the roots of the teeth, and even still higher. In the most happy cases the mucous membrane of the gums unites with the corresponding part of the wound, and yielding to the cutaneous cushion which tends to draw it outwards, is reflected forwards so as to furnish to the margin of the new lip the rosy pellicle which constitutes its natural character. In the least fortunate circumstances, on the contrary, a considerable portion of the jaw remains uncovered; speech is rendered incomplete; the patient continually letting fall his saliva, is obliged to wear a metallic instrument on his chin furnished with sponge. But happily at the present day there exist other means of obviating this inconvenience. (See Cheiloplasm.)

§ 3. *Eversion—Mucous Enlargements.*

Bosselures, a species of reddish prominence which many subjects have on the internal surface of the free border of the lips, is a deformity to which as yet surgery has been but little attracted. It is sometimes observed on the superior lip, sometimes on the inferior, and at times on both at once; in some cases under the form of one or several tubucles, scarcely visible; at other times with the aspect of a transverse eminence, which forces the lip out upon the skin whenever the patient laughs or speaks. It is commonly a congenital blemish, which rarely disappears of itself, and which is sometimes manifested accidentally, particularly in persons who blow the horn or who are obliged to make loud cries. Its presence is not dangerous, and is accompanied with no other inconvenience than of rendering the countenance less agreeable. So the greater part of those who are affected by it carry it during life, without

thinking of getting freed from it. However, it is very inconvenient to certain classes; huntsmen, musicians, and orators for example. Witness two patients operated upon in 1829, by Messrs. Roux and Boyer. Its cure is extremely easy. Excision is performed with curved scissors or the ordinary bistoury. While an assistant stretches the lip by its two angles and brings in view its internal surface, the surgeon seizes the projection as extensively as possible with good forceps held in his left hand, as in excision of the superfluous portion of the conjunctiva in ectropion, and attempts to remove it entire; leaving in its place a regular wound which requires no dressing, and which in general cicatrizes very readily. Numerous facts found in different authors, or gathered from the lectures of M. Dupuytren, prove that at the end of a week or two the cure is complete and the deformity entirely gone.

There is no doubt that the same operation would be applicable to eversion of the lips produced by any other cause, contractions or old cicatrices for example, since this state of the mouth bears the greatest analogy to ectropion or eversion of the eye-lid, and is remediable by the same surgical means.

§ 4. *Hypertrophy.*

The enlargement of the upper lip, almost natural in scrofulous habits, may be carried so far as to constitute a grave malady, or at least a very troublesome deformity. In some cases the whole of the organ acquires such a development, that its posterior face looks downwards and its free border directly forwards. While any morbid action exists; while the hypertrophy is not decidedly fixed and reduced to the state of a simple vice of conformation, we should confine ourselves to appropriate medicines, internal or external, general or topical. But when every resource pointed out by sound reason has been vainly employed, and when the affection is purely local, nothing but cutting instruments can triumph over it, unless the use of compression and caustics be thought preferable. The operation by which the patient is freed from it was first used in 1826, by M. Paillard, who has performed it three times with complete success, and who cites three other cases of success obtained by MM. Marjolin and Belmas. It consists in raising the lining of the lip, and reducing it to its natural thickness by excising a sufficient portion of its tissue.

The assistant, who keeps the head of the patient pressed against his breast, is also charged with stretching the lip and making it project, by taking hold of the left commissure with the fore-finger and thumb of the corresponding hand. Placed in front and a little to the right, the operator seizes the other commissure then with the right hand; armed with a good bistoury, he makes an incision from one labial angle to the other, and perpendicularly upon the margin of the diseased lip, and a little nearer the mucous membrane at its extremities than in its centre; thus having circumscribed all which he intends to bring away, he seizes the flap with the forceps and dissects it rapidly with the same bistoury from the free margin to the adherent edge, and from the left to the right extremity of the organ as far as the sound tissues, endeavoring to give it all necessary breadth and thickness, and taking care to bring it gradually nearer the mucous covering before terminating its excision near the alveolo-labial fossa with a last stroke of the bistoury, or with good

scissors. The wound sometimes bleeds profusely, although in general it readily heals. No dressing is necessary. The wounded surface being continually lubricated by the saliva is soon cleansed. In cicatrizing it reacts upon the integuments; gradually draws them forwards; even tends to incline them downwards, and in case of complete cure the lip not only is restored to the thickness, but even to the direction of its normal condition.

§ 5. *Cheiloplasm.*

The art of restoring or reconstructing mutilated or destroyed lips, has made in our days the most astonishing progress. But a short time since, a loss of substance considerable enough to render simple cheiloraphy useless, seemed to be beyond the resources of surgery. Now, on the contrary, the most hideous deformities do not restrain the skillful operator. If a lip be wanting on either side, in whole or in part, alone or with a portion of the cheek, it is almost always possible to reproduce it by borrowing from the neighboring parts the tissues which are necessary. For the rest, the surgeon must invent rather than learn the art of cheiloplasm. It is an operation which can scarcely be confined to detailed rules, and which must be modified almost as often as performed. All the modes of rhinoplasm have been applied to it. Tagliacozzi is said to have succeeded by the *Itatian* method; that is, by borrowing from the arm the materials for the new lip. Delpech, Lallemand, Dupuytren, Dieffenbach, and Textor have tried the *Indian method*, which consists in taking a tegumentary flap from the neighboring parts, and after inverting and twisting it, fixing it in the place of the destroyed tissues. In fine, the French method, as it is styled by M. Romand in the thesis which he defended on this subject in 1830, a method characterized by the dissection and separation of the internal surface and the stretching the musculo-cutaneous cushion which borders on the opening to be supplied, reckons already a great number of trials. All, even to the ancient method of Celsus, in which incisions whether vertical or horizontal, external or internal, were performed beyond the deformity, have found defenders. Its object being to remedy lesions of form and of different natures, it was to be presumed that each of these methods would soon comprise several distinct processes.

Manual.—1. *Ancient Process.*—If there exist but a hollow in either lip, although very deep, provided that its transverse extent be not too considerable, cheiloplasm differs but very little from the operation for the hare-lip. The first thing necessary is to convert the abnormal deficiency into a recent wound, and give it the form of a V, by paring off its edges and all the diseased portion with the scissors or bistoury. In the second place, the surgeon dissects one after the other the two flaps of soft parts, separates them from the maxillary bone, turns them outwards to beyond the point of the bleeding triangle, and to an extent proportioned to the void to be filled. Nothing then is easier than to stretch them, the one towards the other, and to bring them in contact. In other respects the suture is effected as for the hare-lip, and with the same precautions; the posterior surface of the new lip unites with the subjacent parts at the same time that its two halves become mutually agglutinated; and after the cure its free margin differs in reality from what it was before the disease but by being a little diminished in length.

Nevertheless this process has the disadvantage of contracting the mouth considerably, and of sometimes deforming its aperture quite disagreeably. Celsus very probably had in view something analagous, when he advised to practice a transverse incision, then a crescentic one between the malar bone and the commissure on the internal surface of each cheek, in order to permit the elongation of the two halves of the divided lip. There is every reason to think at least that this kind of cheiloplasm was already thought of, of which Galen and Paulus ægineta also make some mention.

2. *Chopart's Process.*—The preceding method may suffice when the deficiency of substance is not of great breadth; but in other cases it must be rejected, and preference be given to one of the processes which remain to be described. That which according to Carpue, seems to have been designed by Chopart, and which I have seen fully succeed with two subjects operated on by M. Roux, is one of the most valuable. If there is cancer, the surgeon commences by making on each side of the disease and beyond its limits, an incision which descends vertically from the free border of the lip to a point below the jaw; he then dissects the quadrangular flap traced by these two wounds; detaches it from the bone, proceeding from above downwards, preserving to it all possible thickness without cutting too near the periosteum; prolongs it below the chin or towards the thyroid cartilage in proportion to the extent of the diseased parts to be destroyed. This done, he cuts transversely and squarely all the diseased portion, encroaching a little upon the sound tissues, and thus takes off with a single stroke the whole of the cancer; then taking the flap which he has just formed, carries it up and adjusts it upon the chin, and by gentle pulling easily brings its superior margin upon a level with the upper lip, or the remains of the lower: unites it by means of three or four points of the twisted suture on each side to the lateral portions of the face, beginning always with the superior needle; the patient is advised to keep his head bent forwards for some days after the operation to prevent all dragging and laceration of the parts. One must witness it to conceive with what facility these flaps stretch and yield. In one of the cases in which I was assistant to M. Roux, the operator being obliged to remove the whole thickness of the lip beyond the limits of the orbicularis muscle, extended his flap to about the middle of the subhyoid region. Yet nothing was easier than to bring up its edge to a level with the point primitively occupied by the lip. In four days union appeared to be effected. All the needles were brought away. No suppuration supervened, either in its lateral edges or on the posterior face of the flap, and its superior margin soon became invested with a reddish pellicle, in a great measure resembling that which naturally lines the buccal opening; so that on the fifteenth day the patient, who was forty-eight years old, exhibited scarcely any trace of the operation. The second subject was not less fortunate, and I have not learned that any thing unpleasant has since occurred to either. This new lip, nevertheless, having no constrictor muscle, usually remains immovable, fixed against the teeth, and as it were retained from behind; but such slight inconveniences cannot enter into comparison with those induced by the necessity of wearing a silver lip, and patients are too fortunate to be rid of it at this price.

3. *Process of M. Roux, of St. Maximin.*—M. Roux, of St. Maximin, has several times practised cheiloplasm by a process peculiar to himself, and from

which he has obtained remarkable results. Instead of forming a flap to be brought up after excision of the diseased part, this practitioner begins by circumscribing with incisions suitably directed, all which is necessary to destroy in removing the cancer. Then by a careful dissection, he detaches from the maxillary bone and the anterior region of the neck the surrounding soft parts, and thus forms from the skin and cellular tissue a kind of apron, which he brings up to a level with the superior lip and fixes it in front of the jaw either with adhesive strips, or when it is necessary previously to prolong the commissures by a transverse incision, unites and suspends it by some points of suture on each side to the superior edges of the wound. The patient, the assistants, and the surgeon are placed as in the operation for the hare-lip. If the disease extends beyond the transverse boundaries of the inferior lip, M. Roux makes with the scissors a first incision, crescent shaped, an inch or more long, which extends in the same degree each commissure, prolonging them towards the masseters; he performs another on each side with the bistoury, beginning at the external extremity of the former, and bringing them below the cancer, unites them on the chin; removes all the degenerated portions, and in some cases lays bare the whole body of the jaw; dissects what remains of the cheeks by their internal surface; returns to the chin; descends to the submaxillary margin as far as the subhyoid region; preserves as much thickness as possible to the integuments lined with cellular tissue, which he insulates; bringing them upwards, he attaches their extremities to the raw prolongation of the commissures so as to preserve entirely free a sufficient length to represent the margin of the inferior lip, and supports the whole with strips of diachylon, a sling, and retaining bandage. When, on the other hand, one side of the lip is untouched, and the organic change is prolonged for some distance on the cheek of the opposite side, it suffices to extirpate the cancer with three incisions. The one a little curved, transverse, and above the diseased commissure; the second, whether straight or curved is of little consequence, equal in length to the first and continuous with it, descending obliquely in front towards the chin; the third beginning near the sound commissure, and terminating by union with the second. This after the dissection is brought towards the first, and the suture is to keep them in contact. By this proceeding the last ascends to the place of the free margin of the destroyed lip, which it nearly represents, and the form of the mouth is preserved.

4. *Process of Professor Roux.*—In the case of a girl in whom there remained but a very small portion of the inferior lip, and who had also lost since infancy more than half of the superior lip, the maxillary bones had so deviated outwards as to make a considerable projection through the opening. To remedy this horrible deformity, M. Roux, of La Charite, determined to perform the operation at two different times, and executed it in the following manner: after having transformed the inferior half of the wound into a triangle by excision of its borders, he had recourse to the saw to remove about an inch of the jaw, and diminish its contour or prominence; then approximating its two portions he easily brought together the flaps of the recent wound, kept them united by the twisted suture, and thus succeeded in restoring the inferior lip, and curing more than half of the diseased cheek without much difficulty. The success of this first step was complete; but M. Roux,

who wished to act in the same manner for the second, and remove also a portion of the superior jaw, found an insurmountable obstacle in the opposition of the patient, who was satisfied with this first amelioration of her condition. It is very evident, however, that the osseous excision here would have presented much more difficulty than below; and that to effect it it would have been necessary to use the mallet and chisel, or cutting-nippers, in lieu of the saw. By excision of the bone, the surgeon hoped sufficiently to diminish the transverse dimensions of the face, to render practicable the coaptation of the opposite points of the wound. Supposing it could have been attained without it, it is probable that the cicatrix, if it would have formed, being acted upon by the hard parts, would be afterwards torn, or at least there would have remained a very ugly prominence on the corresponding side of the countenance. Apart from this double complication, the method of M. Roux, of St. Maximin, would in my opinion merit the preference.

5. *Modification of M. Lisfranc.*—In October 1829, M. Lisfranc had to treat an old man whose inferior lip was entirely disorganized by a cancer. A crescentic incision, with its concavity upwards, permitted him to detach and excise all the diseased tissues. From the middle of this incision he began another, which he conducted perpendicularly towards the hyoid bone; dissecting successively from the median line towards the sides, and from above downwards, the two flaps thus marked out as in the T incision, he was enabled to bring them up in front of the chin and use them in replacing the lip which he had just extirpated. Several points of the twisted suture kept them in apposition, and sufficed with the four-tailed bandage supplied with lint, to prevent their descent to their natural place. Every thing announced complete success, when about the fifteenth or sixteenth day the patient suddenly died. About the same period, or a little earlier, the fourteenth of July, Mr. Morgan pursued the same plan in London upon an old man, who seems to have received great relief. The operation is certainly more easy by this process than by that of M. Roux, of St. Maximin; but it is doubtful whether we can give as much regularity to the free margin of the new lip as by the process of Chopart. For the rest it is a modification which may have its value, and which enters in part into the first method I have pointed out. The fundamental point is the dissection of the tissues which envelope the bones of the face within the compass of the wound. All the rest belongs to the several variations caused by the kind of lesion to be destroyed. It is the part of the surgeon to multiply or diminish the number of incisions; to determine their form, direction, and depth, every time he is called upon to employ them. The advantages of this method, the origin of which extends back to Frabricius ab Aquapendente, particularly to Franco; which M. Roland, of Toulouse, practised once with success; which M. Blandin has also tried; which I myself tested in 1830, at the hospital St. Antoine, and afterwards at La Pitie in 1831, after the removal of the inferior maxillary bone, and which has very well succeeded in a patient operated upon in October last, by M. Lisfranc, are incontestible. The two fruitless essays of M. Delpech prove that the Indian method holds only a second rank, and that only when the loss of substance is too deep or of too great extent to admit of remedy by the extension of the tissues. The method of Celsus, or of M. Dieffenbach, is in reality but a simple variety of it, good to be called in as

accessary in some particular cases. As to the Italian method, it no longer belongs to the restoration of the lips, but to rhinoplasm. The following article will bring us to appreciate better the value of these remarks :—

§ 6. *Genoplasm.*

The cheeks are also susceptible of being more or less completely reconstructed. A loss of substance in them almost always includes at the same time a portion of the lips, and renders the countenance truly hideous. Thus for twenty years no effort has been left untried to remedy it. M. Delpech and M. Lallemand seem to be the first among the moderns who have given it attention.

1. *Indian Method.*—A young girl, ten years of age, had on the inferior part of the left cheek a wound followed by gangrene, irregularly circular, two inches in diameter, including nearly half an inch of the inferior lip, and a few lines only of the superior. To close this vacancy, M. Lallemand began making raw the whole of its circumference, giving it the form of an ellipse, of a little more curvature above than below, and of which the external extremity of the great diameter fell between the masseter and the depressor anguli oris, while the other ran above and without the prominence of the chin. He then proceeded to cut upon the side of the neck, below the maxillary angle and in front of the sterno-mastoid muscle, a flap of the same shape but fully a third larger, dissecting it carefully and giving it all possible thickness, taking care not to wound the external jugular vein and the ascending branches of the cervical plexus. This flap, oblique from above downwards, and from behind forwards, being no longer connected with the living parts but by a kind of root about an inch wide, the superior edge of which formed a part of the wound, was conducted gradually and without twisting by a movement of its whole body from below upwards into the latter, where the operator fixed it by different points of interrupted suture, plaster strips, compresses of charpie, and several turns of a bandage. The elliptic form was preferred for the purpose of facilitating the union of the wound in the neck, and twisting was avoided, because the surgeon was apprehensive lest gangrene should be determined to the borrowed parts, as M. Delpech experienced in a case where he had to obtain the integuments beneath the jaw, and brought them up by doubling them in front of the chin. M. Lallemand's operation succeeded only after many accidents. The wound was torn open several times in consequence of the cries and indocility of the child, and more perhaps from the presence of a canine tooth which had deviated outwards, and which it became necessary to extract. The cure was however at length completed. Mr. Texor, who practiced according to the Indian method in 1827, obtained from it he says perfect success. All the needles were withdrawn on the seventh day, and cicatrization was complete on the twenty-seventh. Since then M. Dupuytren has made an attempt of a similar kind after the principles of M. Lallemand, and in a case much more complicated. His operation belongs both to cheiloplasm and genoplasm. The patient was a child, of nine years of age, who in consequence of gangrene had lost the left half of the inferior maxillary bone, as well as the corresponding part of the cheek below the labial commissure, and to within three lines of the

masseter muscle. The operation was performed in the month of August 1829. The flap was taken from before the sterno-mastoid muscle, twisted upon itself, and fixed to the freshened edges of the wound by five points of suture. The anterior needle first, and afterwards that which formed the connection below, cut through the tissues and became detached. Its inferior edge only became gangrenous and suppurated. An opening an inch in length, having its base at the free edge of the lip, was the consequence. In every other part union took place. To remove this new opening M. Dupuytren treated it as a simple hare-lip, but the tongue which had contracted unnatural adhesions on this side was an obstacle to the final success of an agglutination, which at first seemed to have perfectly succeeded. The fact at least proves that torsion, so much feared by M. Lallemand, does not necessarily induce mortification of the flap which is subjected to it, and that in strictness we may go to the neck for the integuments necessary to fill up wounds on the cheek attended with loss of substance.

2. *French Method.—a. Process of M. Roux, of St. Maximin.*—In a case similar to that of M. Lallemand, M. Roux, of St. Maximin, followed another mode. The cancer had destroyed the left cheek, including part of the lips, and produced at this place an ulcer measuring two inches perpendicularly, and one and a half transversely. By means of two crescentic incisions, which, beginning at the lips, were united in front of the masseter muscle, the surgeon made an incision of the carcinoma, and obtained instead a fresh elliptic wound a little more extended in breadth than in height, so that he might be able to approximate its borders; he then dissected away at first all the inferior lip, nearly to the right masseter and beneath the chin; he performed the same on the left cheek, and the curved borders of the solution of continuity were afterwards easily brought to face each other. The twisted suture, adhesive strips, and the retaining bandage applied as usual, prevented all subsequent displacement, and the cure took place in a very short time.

b. Process of M. Gensoul.—A woman about fifty years of age, had had gangrene of the left cheek in her ninth year; admitted to the hospital of Lyons in June 1829, she exhibited on the left side of the mouth an enormous loss of substance, which left exposed a great part of both jaws, the two lateral incisors, the two canine, and the first three molar teeth of this side all considerably deviating outwards. The circumference of the ulcer which had been long cicatrized adhered intimately to the bone, and had produced anchylosis of the inferior maxilla. After separating it from the bone and making it raw, M. Gensoul detached the rest of the cheek as well as the corresponding extremity of the lips, above, below, and then behind, from the adjacent tissues, as far as the neck on one side and upon the masseter on the other; he then had recourse to the mallet and chisel to remove the projection of the prominent maxilla, as well as the teeth implanted in it. He was then able to approximate the two edges of the wound and perform the suture. A small salivary fistula is all that now remains of so vast a disorganization.

c. Process of Professor Roux.—The following is a case which I witnessed, and which, though to be confounded with the preceding cases, yet differs in some points of view:—a young woman twenty years old, endowed with indomitable fortitude and uncommon docility, had two years previously the ala of the nose, the half of the superior lip, and all the cheek situated above

the horizontal line of the mouth, destroyed by gangrene. There was also necrosis of a portion of the maxillary bone, from which resulted a communication of the sore with the nasal fossæ and the maxillary sinus; and the tongue was continually thrust from the mouth. Having entered *La Charite* in the summer of 1826, M. Roux yielded to her urgent entreaties and undertook her cure. To accomplish it he performed seven different operations, which occupied a whole year. The first attempt permitted him to insulate the left side of the inferior lip, and displace it by carrying it upwards to serve for renewing the destroyed portion of the superior. Every thing in this operation succeeded to the wish of the operator. The buccal opening was thereby completely separated from the sore, which was reduced to a large circular ulcer, which M. Roux tried in vain to close by paring its edges and bringing them together with the suture. A flap detached from the posterior face of the lip by separating the lining membrane and inverting it upwards, succeeded no better. It was the same with an attempt to accomplish it by integuments from the palm of the hand. He took the course of bringing upwards and outwards, to unite it with the ala of the nose and the corresponding half of the sore, the flap which the superior lip had borrowed from the one beneath. A triangular opening as in the hare-lip, and of considerable size at the left commissure of the mouth, was the result of this new displacement. The surgeon did not hesitate a short time after to pare the edges; they were easily adapted, the suture was performed, and this was the least troublesome of all his efforts. At present, three years after the cure, there remain in this patient no traces of her ancient deformity except a slight contraction of mouth, and on the cheek some marks such as follow a burn.

All these modes of performing genoplasm having been devised for as many individual and dissimilar cases, it would be superfluous to compare them in order to point out their differences. The able surgeon must see which is most proper for the case before him. It is much the same in cheiloplasm; consequently I have thought proper to leave the decision to the sagacity of the reader. Franco had conceived the idea of this operation, and his observation demonstrates beyond doubt that he understood cheiloplasm, and especially genoplasm, almost as well as modern operators. "A James Janot," says he, "had a defluxion which fell in his cheek, and destroyed the said cheek or the greater part of it, and likewise the mandibles, from which he lost several teeth, and there remained a hole through which you might put a goose's egg. To come to the cure, I took a little razor and cut the edge or skin all around. Afterwards I divided the skin opposite the ear, and towards the eye, and towards the inferior mandible; then I cut within lengthwise and crosswise to lengthen the lips, taking care always not to come through, for the skin was not to be cut. I immediately applied seven wound needles, of which, at the end of four or five days, three fell out, which had to be replaced by others. In short he was cured within fourteen days." But the simple narration of this long history should be read in the author himself.

§ 7. *Abnormal Coarctations.*

In consequence of tetters, burns, ulcerations, &c., the anterior orifice of the mouth is sometimes so contracted as to disfigure the patient and interfere

with the functions of this cavity. At the sight of such an evil, the first resource that presents itself to the mind is mechanical dilatation. Unfortunately this only succeeds temporarily, and perhaps never has procured permanent relief. After dilatation comes incision of the commissures, which we should be careful to extend a little further than we wish the mouth to open, as in cicatrizing the wound will always contract. If it were easy to cause the two edges of the solution of continuity to cicatrize separately this operation would perfectly attain the end proposed; but this is not the case. Notwithstanding the cloths spread with cerate, the leaf of lead interposed, and the little hooks by which continual traction is exercised upon the angles of the wound, it still most frequently ends in becoming agglutinated and restoring things to their previous condition if the deformity itself be not even aggravated. Some practitioners have thought to surmount this obstacle by treating coarctation of the lips with a leaden wire. A trocar carried through from the skin towards the mouth makes a passage for the wire, the buccal extremity of which being brought back through the natural opening, is to be united with the other, so that the surgeon may twist them as in *fistula in ano*, and insensibly cut through the interposed tissues. This process, less startling to patients although much longer than the preceding, is however not more certain. In proportion as the wire cuts through the parts they reunite beyond it, so that in the end the ligature is not more efficacious than incision.

Excision.—Aware of these obstacles and the insufficiency of known means, M. Dieffenbach supposed that by excising a portion of the thickness of each labial angle, to the extent of an inch for example, leaving the mucous membrane wholly untouched, a complete success might be obtained. Facts have justified his theory, and already he reckons several instances which leave nothing further to be desired. His process, more easy to comprehend than to execute, is however within the reach of all. The surgeon introduces the extremity of a finger in the mouth of the patient, to support and protect the organic cushion which he intends to preserve. With the other hand he carries one blade of the scissors upon the edge of the coarcted opening a little above the commissure, and enters it with precaution from before backwards between the mucous membrane and the other tissues, until on a level with the point where he wishes to place the corresponding angle of the lips, and cuts at a single stroke and squarely all that is included between the blades of the instrument; he then makes a second incision a little lower down, parallel and similar to the first, pursuing the same course with the inferior lip as with the upper; he then unites them, and by a small crescentic section at their posterior extremity, insulates the strip thus formed and cuts it off, always without touching the mucous membrane, which he detaches afterwards all round the loss of substance; the same is performed on the opposite side; he then gently separates the jaws so as to stretch the portion forming the floor of the wound, and divides into two equal portions this membranous layer until within three lines of its genal extremity; brings it outwards and reflects it first upon the labial commissure which he has just established, then upon the inferior edge, and lastly on the superior edge of the division; fixes it there as well as to the red pellicle of each margin of the lips, by a sufficient number of fine short needles, or the twisted suture, alone or combined with the interrupted suture; and employs it, in fine, as a kind of border, and unites it to the

integuments in a sort of hem, in the manner that a shoemaker unites to the leather of his shoes the last binding which is to cover their edges. If the mucous layer, which need not be made very thin, be well stretched and well fastened upon the bleeding edges of the wound, it adheres with the greatest facility in the course of a few days. The artificial portion of the lips having in consequence been brought to the same state of organization as the natural portion, their adhesion is no more to be apprehended at the sides than towards the middle. Nothing is more ingenious than this process, and it bids fair to be generally adopted. Applicable to every shade and degree of the disease, whether acquired or congenital, and to all ages, its only difficulty is its delicacy of execution. It ought, therefore, be always attempted when the coarctation is not surrounded by too great an alteration in the internal membrane of the lips.

Art. 2.—Salivary Apparatus.

§ 1. *Fistulæ.*

A. *Of the Parotid Gland or its Excretory Ducts.*—No means have been left untried in the cure of salivary fistulæ, and it must be admitted that nearly all have met with some share of success.

1. *Cauterization*, whether with hot iron or chemical substances, employed successfully by Galen on a patient in whom the fistula, caused by critical inflammation of the gland, was situated beneath the ear; by Pare, the two Fabricii, Heuermann, M. Boyer, Langenbeck, and a host of others, succeeded very well in fistulæ of the gland itself; that is, in those which took their origin from some of the radicles, and not from the principal trunk of the excretory salivary canals. Galen used catheteric plasters; Pare, aqua fortis; Diemerbroeck and Jourdain, actual cautery; M. Higginbottom, sulphuric acid; and M. Boyer, the nitrate of silver. The lapis infernalis deserves the preference, both because it is more convenient and because it produces an eschar drier and more adherent than any other. However, if the ulceration be deep and narrow, a troche of minium may be substituted for the nitrate of silver, as I tried with success in November, 1831, at La Pitie, on a man who had a parotid fistula in consequence of the opening of an abscess behind the maxillary limits. Styptics and astringents, equally lauded by some practitioners and among the rest by Becket, being less efficacious than caustics, have been long since abandoned.

2. *Compression*, used with success by Beaupre, Le Dran, and Ruffin, who invented a machine for the purpose; extolled also by Imbert, Jourdain, and Richter, is nearly always sufficient when it can be borne by the patient, and when the state of the parts permits its employment. For this end charpie or graduated compresses are applied upon the fistulous orifice; then with a four-tailed bandage and a halter, or turns of a bandage properly distributed, this point is acted upon in a manner to keep in contact the parietes of the diseased duct.

3. *Irritating Injections*, proposed by Louis, are intended to inflame the fistulous opening and determine the adhesion of its sides. They may consist of barley-water with honey, the decoction of Provence roses in red wine, and

even of alcohol, according to the irritability of the tissues in which adhesive inflammation is desired. It is a remedy which holds only a third rank, because it is attended with more risk of accidents, and does not always cure. Yet in some cases of obstinate fistula it is not to be despised.

4. If neither of these means succeed, excision may be tried by comprising the ulcer within an elliptical incision, and uniting its sides by adhesive strips or the twisted suture. If the disease still persist, nothing remains but to attempt extirpation of the gland; but this project, ascribed to Pouteau by M. Hedelhoffer, has never I believe been put into execution. It would, indeed, form a case in which it might be said that the remedy was worse than the disease: the more truly so, as fistulæ sometimes disappear spontaneously, of which M. Richerand gives two examples.

B. *Of the Duct of Steno.*—Applied to fistulæ of the stenonian duct, these various treatments, although of less efficacy, still reckon a certain number of undeniable cures.

1. *Cauterization*, for example, alone or assisted by compression, procured for Louis an unhoped for cure upon a subject who had carried his fistula for nineteen years, and submitted to several operations without success. Ferrand, Nedel, Mursinna, Imbert, Jourdain, and M. Langenbeck have been no less successful.

2. *Compression*, without caustic, and as a single means, has on its part appeared sufficient. Maisonneuve, who first advised it in this case, established it between the fistula and the gland for the rational purpose of closing the passage to the saliva, and permitting the opening to cicatrize. His patient, who had received a sabre cut on the cheek, was radically cured at the end of twenty days. Louis, and with him most of the moderns, have thought that by this mode inflammation will be almost necessarily determined to the whole extent of the parotid gland, and consequently it could not fail to be dangerous. Desault thought to dissipate these fears by directing compression upon the gland itself, in which he proposed to induce atrophy. Whether this atrophy really took place, as Desault affirms, or whether the parotid gland continued its functions afterwards, as M. Boyer seems to think, it is the fact that the fistula cicatrized early, and the patient had no return of it afterwards. However it may be, there are in the designs of these authors two ideas which it is necessary not to confound; that of Maisonneuve, who wished to suspend for a time the flow of the saliva; and that of Desault, who preferred to dry up its source. Without believing with Heuermann that the parotid gland would form abscess, ulcerate, or pass to the state of scirrhus or cancer, I cannot yet admit that such means are harmless; they ought, in my opinion, to be reserved for subjects whom every other operation alarms or has failed to cure.

3. *Ligature of the Duct.*—Zang, who partakes of the opinions both of Maisonneuve and of Desault, recurs to the process of Viborg for determining atrophy of the parotid gland. Instead of compression, which is always uncertain, this surgeon proposes, as the object is to prevent the passage of the saliva, to apply a ligature to the duct of Steno beyond the fistula. Numerous experiments upon animals towards the close of the last century convinced him that this ligature is not dangerous, and is always successful. To apply it, it is best to make a vertical incision about an inch long over the anterior margin of the masseter muscle, immediately below the zygomatic arch, and

divide successively the skin, the adipose layer, and then a fibro-cellular expansion which spreads over the buccinator muscle. The duct being exposed, is to be isolated from the other tissues, particularly the branch of the facial nerve which runs along its superior edge. Nothing then is easier than to pass a thread around it and obliterate it. Doubtless, if the sacrifice of the functions of the parotid gland has been previously determined, the advice of Viborg ought to be followed to the exclusion of that of Desault and of Flajani; but compression, having the advantage of requiring no incision, will nevertheless be adopted in preference by timid and pusillanimous patients; whence it follows that these two modes will have in practice each its particular application.

4. *The Twisted Suture*, as in hare-lip, when the anterior portion of the canal remains free, is sufficient in many cases, according to Flajani, Percy, Zang, &c., and most frequently renders all other means unnecessary, if applied in good time.

5. *To Re-establish the Natural Passage.*—Morand first, and after him Louis, are the two authors to whom is due the idea of dilating the duct of Steno to cure fistula of that part. Placed in front of the patient the surgeon takes the labial angle between the thumb, introduced within the mouth, and the first two fingers of the left hand upon the right cheek, but with the right, if the fistula is on the left side; stretches and turns it outwards; then introduces with the other hand the head of a fine stylet armed with a thread, into the natural orifice of the parotid duct; withdraws it through the fistulous opening, where he leaves the little seton, the two extremities of which he unites by a knot, and which is made use of the next day to draw a cord of silk into the mouth from the exterior to the interior; he renews this seton every day, bringing it out by the wound, and increases its size every time by the addition of a thread. When it is too difficult to penetrate by the mouth, Louis introduces the stylet through the sore; it should indeed be quite indifferent whether it be introduced by one way or the other. In this last case, however, the thumb should take the place of the fingers in order to straighten the canal and to incline its orifice forwards when the stylet is about to come through; not because it makes a bend in passing through the buccinator, as is generally admitted from the observation of Louis, but because it enters the mucous membrane at an acute angle, which closes it in a great measure, and seems to throw its opening a line backwards.

When the saliva passes freely into the mouth and the ulcer is contracted to the size of the seton, it is to be removed, or, what is better, cut off on a level with the integuments, and drawn forwards about a line by its buccal extremity so as not to be wholly withdrawn until the fistula is entirely closed by means of repeated cauterizations and desiccative applications. If it were always easy to find the anterior termination of the divided canal; if this canal were not generally long obliterated when the surgeon is called in; if, lastly, it were very important to preserve it, the process of Louis, exactly traced out from the idea of Mejean in the treatment of lachrymal fistula, would certainly have obtained general assent; but the fact is otherwise, and the following mode is generally adopted by operators at the present day.

6. *Establishment of a New Passage.*—*Deroy*, who, as it is said by Saviard, seems to have devised this method, perforated the cheek with a hot iron,

thus removing a portion of matter and curing his patient. Shortly after Cheselden gave the same advice. *Duphenix* performed it in a different manner. He made use of a long narrow bistoury, inserting it from above downwards and from before backwards, turning it several times on its axis to make his opening of a round form; he then introduced in its place a canula shaped like the point of a pen, designed to conduct the saliva into the mouth, the external extremity of which, concealed within the cheek, was to correspond with the parotid opening of the fistula. The edges of the ulcer were then pared, and in conclusion Duphenix had immediate recourse to the twisted suture. The canula left to itself came away on the sixteenth day, and the cure was completed. According to *Monro* a shoemaker's awl was advantageously substituted for the cautery of Deroy and the bistoury of Duphenix. With this instrument, of which the celebrated Edinburgh surgeon seemed to be very fond, he traversed the cheek in the natural direction of the canal, and for a seton used a thread passed through the wound. When the passage had become callous he withdrew the thread, saw the saliva flow into the mouth, and then gave his attention to the small external ulcer. *Platner*, a great partisan of this mode of operating, recommends the patient to gargle with brandy in order to hasten the induration of the internal orifice of the new duct, and at the same time to compress the exterior of the wound, or to touch it with nitrate of silver. After perforating the parts *J. L. Petit* advises to enlarge the buccal opening by introducing within it every day a small piece of sponge, until the fistula is closed. *Tessort* saw the saliva return to the mouth, from passing a simple thread through the cheek; the use of adhesive strips sufficed for the ready cure of the ulcer. Flajani advises to pass a double silk thread through the fistula by means of a needle, and in the rest to follow the example of Monro. In a patient who could not support compression, Desault employed a hydrocele trocar to pass the thread through the cheek; to the internal extremity of this thread was tied a seton, which he drew from the mouth to the bottom of the fistula, yet in such a way as not to prevent cicatrization. The seton was withdrawn, and replaced daily by one a little larger, and discontinued several days before the thread which held it, and when the opening had become almost completely closed. Like Desault, *Bilguer* also had recourse to the trocar; but instead of the seton he left a leaden canula within the internal half of the wound, which he closed over it. Richter carried into the mouth a piece of cork to support and receive the point of the trocar; and used a seton of thread, the size of which he gradually increased. He withdrew it when the new canal was become sufficiently firm, and cauterized the opening on the exterior, or scarified it and brought its edges together. In more obstinate cases he introduced by the mouth into the artificial duct, and there left to remain, a canula of gold or silver, furnished with a button to prevent its slipping away. More recently, in 1824, *M. Atti*, intending to improve the process called Beclard's, has rather modified that of Desault. The canula of a small trocar served him to conduct through the cheek a tent of lead, pierced laterally with several holes, supported by a thread from without which kept it within the wound, and divided to the extent of about a line from its internal extremity into three branches, which being bent over in the mouth prevented its being drawn out by the thread. When the fistula is sufficiently reduced, M. Atti touches it with lapis infernalis after

bringing away the thread, and attempts to close it entirely. The tent of lead left within the cheek escaping after some time into the mouth, leaves behind a new canal which perfectly supplies the place of the original. The successes which the author adduces in support of his ideas confirm their correctness, and his process is without dispute at the same time one of the most simple, the most ingenious, and the most certain that can be imagined. It is assuredly preferable, for example, to that of *Mr. Charles Bell*, who, like Flajani, passes a needle through the cheek to carry first a thread and then a seton into the fistula, and when the internal opening is callous, attaches a hair or very fine thread to the external extremity of this thread, and then treats it like Desault or Bilguer.

7. In the hope of rendering the operation more prompt, and union of the ulcer more immediate, surgeons for these thirty years have directed their views to another course. Rejecting all species of foreign bodies, *M. Langenbeck* proposed to dissect and insulate the posterior end of the duct of Steno; to make at the bottom of the fistula an opening, which would admit of its being conducted into the mouth, and to fix it in its new relations, immediately to unite the edges of the opening. But this professor has not as yet, to my knowledge, found imitators, and ought not in future. *M. Latta* says that the best mode of curing salivary fistulæ consists in passing a string of catgut through the cheek; then to try to engage its external extremity in the parotid duct, leaving the other within the mouth, and close the wound by the suture or by plasters; as if it were always possible to find the orifice of the Stenonian duct at the bottom of an ulcer! Zang, however extols this mode of proceeding when the fistula is very large and the anterior portion of the canal obstructed, but he advises the use of the canula of the trocar for introducing the catgut; that this cord be sharpened to a point at the extremity which is to penetrate the duct towards the gland, and that it should not entirely fill the artificial canal, but permit the saliva to flow along its side. Placing the practice of Latta and Zang upon its true ground, it is easily perceived that it differs in reality from that of Desault and Charles Bell, only in their dispensing with retaining their tent from without by means of a foreign body. This allows them to close the fistula at once, and that whether they have succeeded or not in inserting the end of the cord into the natural duct of the gland. It is then possible to effect a cure in this manner, as by most of the processes heretofore described; but it has the inconvenience of not holding the seton firmly enough within the substance of the cheek, and of permitting it to escape too soon. It is an objection which might be equally applied to *Percy*, who says he has frequently succeeded by using a leaden wire instead of the catgut employed by the Germans. To obviate this objection *M. de Guise* took the following method with a young person, whose fistula, already chronic, had resisted various methods. A hydrocele trocar carried through the sore from without inwards, and from before backwards, allowed him to carry through its canula a leaden wire into the mouth. By a second puncture in the course of the natural canal, that is, from behind forwards and always from without inwards, he was enabled to carry the other extremity of the wire into the buccal cavity, to bend the two portions on the internal surface of the cheek, and to unite the external opening by the twisted suture. After several days, agglutination seemed complete. The coil of lead, whose convexity corresponded with the

fistula, and which embraced in its concavity the internal cushion of the cheek, was carefully withdrawn, and the cure was no longer doubtful. Three observations, recorded in the name of Beclard in the Archives, prove that this surgeon has often imitated M. de Guise with success. Instead of leaving the two extremities of the leaden wire loose in the mouth, he united and twisted them together for the purpose of insensibly cutting through the interposed tissues, as in fistula in ano. Moreover, in making the second puncture he carried the trocar through the mouth in order that the beak of the canula might not prevent its being withdrawn the same way after having placed the second end of the tent, which is not possible when it is directed from the exterior to the interior, as at first. Finding that it was not as easy to carry the trocar through the mouth as through the sore, and desiring to remedy the inconvenience complained of by Beclard, *M. Grosserio* proposed a trocar fitted with a canula deprived of its shoulder. With this modification it is quite as easily withdrawn through the mouth in the second step of the operation as through the wound in the first. In fine, *M. Mirault*, who has since made the same proposition, thinks that a seton of thread will be better than a wire of lead, and that with the assistance of a *serre-nœud* modelled on that of Desault the end would be more easily attained than by simple torsion. Acting on the idea of M. Mirault, *M. Roux* used a seton of silk with full success. Lastly, *M. Vernhes* has been equally fortunate with a gold wire passed from above downwards, and not across as by M. de Guise, and which he used like Beclard, to cut through the interposed substance by gradually twisting it upon itself. Perhaps also we might confine ourselves to puncturing in some way the parotid duct posteriorly, so as to establish an internal fistula in the salivary passage and be enabled to close the one without. But this process, which I proposed in 1823, has not as yet been put to the test. Like that of M. de Guise and all its gradations, it would only be applicable in cases where the wound of the canal is not too near the masseter muscle. To determine the relative value of so many different processes, it would be necessary to represent every shade of difference that may be exhibited in salivary fistulæ. In this point of view there are few which have not their advantageous side. However, the seton after the manner of Desault or Charles Bell, the tent of lead of M. Atti, that of Percy, of Latta or Zang, are best in every respect, and ought to be preferred. To follow M. de Guise or Beclard with the modification proposed by M. Grosserio, it is required that the fistula be at some distance from the masseter muscle; in which case it is the most certain method, and undeniably superior to all others.

C. *Fistula of the Submaxillary Gland.*—If it happen, of which examples have been deduced, that a sore or an ulcer of the subhyoid region should extend to the submaxillary gland and remain fistulous, to effect its cure all the means would have to be tried which have passed in review on the occasion of fistulas of the parotid gland. If nothing can dry up the source of such an evil; if especially the secretory organ itself be altered to a great degree, and threatened with an unfortunate degeneration, extirpation, which Pouteau was bold enough to conceive for the parotid, would here be a last resource, which should not be neglected. M. Amussat has performed it with entire satisfaction. The process to be followed in such a case will be discussed hereafter.

§ 2. *Ranula or Frog's-tongue.*

History.—Ranula is a disease of little importance, and generally, according to Boyer, not dangerous. It has more than once, however, been seen to endanger the life of the patient, and in every case is sufficiently troublesome to create the desire of getting rid of it. De Hilden records one which filled the whole mouth; Marchetti another, which compressed the carotid arteries and the trachea. Alix is said to have operated on one, which was on the point of suffocating a child; and Taillardaut on another, so voluminous as to prevent the patient from eating. Burns relates, that a man who waited in the study of Cline had his respiration so embarrassed by the presence of a ranula, that he dropped down insensible after having experienced violent convulsions. Although the ancients understood but imperfectly the nature of this disease; though some made it an encysted tumor, with Celsus; though others, with Aetius, considered it as a varicose dilatation of the sublingual veins, or with Abul-Kasem as cancer; with Paracelsus, as an aposteme of the vessels of the tongue; or as an ordinary abscess with Aranzi; they nevertheless attempted its cure by almost all the means employed since Louis endeavored to prove that it is nothing more than a tumor caused by an accumulation of saliva, either in the maxillary gland itself, converted into a cyst, or in its excretory duct, enormously dilated. Instead of pure and limpid saliva; of inspissated saliva, of mucus, of purulent matter; or of a viscous substance more or less consistent, the morbid pouch is sometimes filled with gravel, sand, or even true calculi. In a case reported by Tulpius, it was formed by a concretion so hard as to require the employment of actual cautery to destroy it. Schultz, E. Kœnig, and V. Rieddlin cite cases of the same kind, which have also been met with by J. L. Petit, Freeman, Sabatier, Taillardaut, Loder, and M. Boyer. In all these observations the indication was precise. A free incision of the tumor permitted the extraction of the foreign substances, and the cure was speedily effected.

Indication.—Ranula, properly speaking, requires other attentions. Experience proves that evacuation of the fluid is not sufficient to prevent its return. Incision, caustics, tents, dilatation, excision, extirpation, canulæ, the seton, &c., have each in turn had its partisans on this point.

1. *Incision*, which first presents itself, at once empties the tumor and seems to have cured the disease. Besides, nature would seem to have suggested the first idea of this, since the ranula frequently opens spontaneously. Hippocrates recommended it, and performed it with a lancet. Celsus and Aetius mention it, but do not seem to place much confidence in it; nor did Rhazes, who was apprehensive for the vessels which the bistoury might divide at the same time. Although somewhat bolder, Abul-Kasem did not venture to have recourse to it, except in sublingual tumors of a light color and fluctuating, fearful that by incising others there would be danger of their passing into a cancerous condition; that is to say, Abul-Kasem had been led unwittingly to distinguish true ranula from the tumors with which in his time it was confounded. Instead of plunging the instrument into the cyst itself, Paracelsus merely opened the vessels running into it, and consequently can scarcely be considered as one of the partisans of incision of the ranula. When fluctuation was perceived, Aranzi, who did not distinguish it from abscess, advises

it to be opened with the lancet, and P. Forrest asserts that it will not return, if, after opening it, the surgeon takes care to press it and evacuate all the matter. According to Bartholin, *Six* waited until inflammation had ceased in the tumor, and then pierced it through and through to evacuate its contents. Notwithstanding the reasons of V. D. Wiell and daily experience, Jourdain, about the middle of the last century, still maintained that a large incision with the lancet very frequently cured ranula, and that its treatment may be confined to this. There are, indeed, some subjects who are thus finally rid of their disease, but every one at the present day agrees that it is but a palliative remedy, and that generally the salivary cyst is sure to be refilled.

2. *Catheterics.—Injections.—Tents.*—To preserve to the operation a part of its ancient simplicity; to prevent the wound from closing too rapidly; to obtain, in fine, a cure which incision alone was far from always obtaining, Paracelsus kept detersive substances within the wound; Purmann introduced styptics into it, and was imitated with success by V. D. Wiell; Camper touched it with lapis infernalis, and Acrel left in it a dossil of lint steeped in spirit of salt; Callisen advised to place in it lint alone, or to cauterize its cavity with a mineral acid; by which means he said the cyst would become detached and might be brought away. A surgeon of Saltzburg, quoted by Sprengel, found it more convenient to make injections of camphorated spirits or oil of turpentine, and cured his patient. It was the same in the case mentioned by M. Haime, of Tours, which he also cured by means of injections, thereby causing adhesion of the parietes of the cyst. Leclerc was no less fortunate with the nitrate of mercury, and the observation of Sabatier proves that a tent of charpie renewed or cleansed every day sufficed, after incision of the ranula, to render the wound fistulous and the cure radical. Yet as it is not rare for the disease to resist this combination of means, it has been devised to destroy a part of the sac which constitutes it.

3. *Cauterization.*—Caustics were employed from the time of Aetius. Dionis preferred a mixture of sulphuric acid and honey; but the hot iron has found a greater number of partisans than escharotics, properly so called. These latter are indeed more difficult of management, more uncertain in their action, and almost always dangerous when carried into a part so delicate as the mouth. Pare, who had experienced their disadvantages, conceived the design of plunging into the tumor a kind of trocar, at a white heat, through a metallic plate intended to protect the adjoining parts. In this way he produced a loss of substance, the wound became fistulous, and the ranula never returned. Aquapendente carried his cautery through a barred canula. Louis advises much the same thing; that is, he prefers the actual cautery to a cutting instrument. He merely remarks, that by making the orifice in front we expose the saliva to spout out and escape involuntarily from the mouth. Nevertheless, cauterization is rather rarely employed in our day, as much perhaps on account of the fright it gives the patient as of its not being very infallible. M. Larrey, who advises that the red hot iron should traverse the tumor through its whole extent, is almost the only one who continues to accord it the preference.

4. *Excision.*—In introducing the process of La Cerlata, who held the ranula with a hook and excised it with a razor; or that of Aquapendente, who seized it with forceps and cut it off with scissors, or passed around it a ligature;

Tulpius, J. L. Petit, Desault, and Richter have labored to show that after the removal of a sufficiently large flap from the cyst, the tumor is seldom reproduced. The fact is, that Desault, in his practice at the Hotel-Dieu, has generally succeeded in this manner, which M. Coley has so much praised, and of which M. Boyer, who followed the same plan, has the highest opinion. It is performed in different ways. The most simple and most certain is the following: the jaws of the patient being separated as widely as possible, the surgeon, armed with a straight bistoury, commences by making a crescentic incision with its convexity external through nearly all the gingival surface of the tumor; he then seizes with good dissecting forceps the flap thus marked out and detaches it with the scissors, giving it the form of an ellipse. Generally no vessel of importance is opened. It is seldom that more than a few drops of blood flow, or that the patient feels much pain. Dressings are unnecessary, and the wound, which becomes smaller and smaller every day, but usually without closing entirely, prevents the danger of relapse.

5. *Extirpation.*—Loder and Sabatier have, however, seen the disease resist this treatment, and many authors have also maintained that the certain mode is to extirpate the ranula, or destroy it entirely with caustics. A rather obscure passage in his works leads to the opinion that Celsus himself advised this last resource. Treating of sublingual tumors he says, when they do not yield to puncturing we should incise the skin that covers them in order to extract them, taking care not to wound the vessels, while an assistant separates the lips of the wound. Mercuriali, the first author who distinctly prescribes it, raises the tumor with a hook, cuts it at its base in the mouth, and says if the whole of the cyst is not destroyed the disease will not fail to be reproduced. Diemerbroeck commenced with a crucial incision, and extirpated it entire. Without going so far, Alix cut into it freely, but lengthwise, and brought away with the scissors as much of the cyst as he could. In a very serious case, Marchetti, who had introduced a seton into the mouth penetrating from the supra-hyoid region, was notwithstanding obliged to extirpate all he could of the tumor, and destroy what remained with a hot iron. It seems evident however that complete extirpation is seldom indispensable, at least when the disease is not threatened with fearful degeneracy or transformed into a solid tumor. Otherwise it is quite sufficient to excise the portion projecting into the mouth; the more so, since by then touching the bottom of the wound plentifully with nitrate of silver, sloughing will be readily produced.

6. *Dilatation.*—Although the disease consists generally in the course of the saliva not being free; although Louis, imitated by Leclerc, succeeded in opening the ducts of Wharton, which appeared like two apthæ on the sides of the frænum; though he was able to dilate them by placing a sound within them, and the patients thus treated were cured; yet it must be acknowledged in accordance with Richter, that dilatation would here be the most defective and trifling resource, and sometimes even altogether impracticable. Excision after the manner of M. Boyer has great and indisputable advantages over it, without being subject to the same uncertainty and the same difficulties.

7. *Permanent Canula.*—This has not prevented some modern operators to decide for incision, which they have thought to render more efficacious by combining it with the use of a canula left within the opening of the cyst. The

idea of such an association had not, I believe, been published before Sabatier. Still this author only speaks of a canula left in the wound long enough to render it callous. But at his time it had evidently presented itself to the minds of some other practitioners, since he makes mention of a patient who had worn one for three years, and whom he advised to continue its use. It was about an inch long, with a lenticular button at one of its extremities, which prevented it from penetrating too far, and did not sensibly affect the speech or mastication of the person who used it. This canula M. Dupuytren has modified in an ingenious manner, by making it considerably shorter, and terminating each extremity with a lenticular plate. After opening and emptying the cyst, this professor engages within it one of the buttons of his instrument, the other disk of which remains in the mouth. The tissues which embrace the neck of the instrument in a short time contract so as to prevent its derangement in any way. The saliva escapes by its canal, and the patient wears it as long as it is deemed necessary, sometimes even during life, without any real inconvenience. M. Dupuytren has the plates of his instrument, which should be of gold, silver, or platina, convex on their free surface only, and concave inwards, so that the food may not find its way between it and the parietes of the cyst. Nothing, it is true, prevents the trial of this method, which, according to the new editors of Sabatier, constantly succeeds at the Hotel-Dieu. But I do not see that it has in reality a great advantage over simple excision, which on the other hand is rarely followed with failure in the practice of M. Boyer. It is seen from this view of the subject that the treatment of ranula is wholly founded on that of hydrocele, as M. Haime has moreover remarked, with Purmann, who endeavored to produce adhesive inflammation of the salivary cyst in the way that adhesive inflammation is caused in the tunica vaginalis. The seton itself has not been wanting in this case, and it might be used with some probability of success, if other modes were not a thousand times more rational. As proved by the practice of Dr. Physick, who has long employed it, and the observations of Mr. Lloyd, who also used it in London, and the work recently published by M. Langier, this resource is not without a certain degree of efficacy.

§ 3. *Salivary Tumors foreign to the Excretory Canal.*

Tumors, apparently salivary, are sometimes seen elsewhere than at the sides of the tongue. I attended a patient in the hospital Saint Antoine, who had one for a long time between the lip and the left superior alveolar arch, of which he rid himself every month by opening it with a bistoury or lancet. M. Græfe says he has often observed it in the substance of the lips. Wilmer mentions one which was located in the inferior maxilla; and M. Dupuytren has often met with them in the substance of the bone itself. The one treated by M. Latour occupied a great portion of the cheek; and M. Ricord has published, under the title of "Hydatid of the Canine Fossa," a case which probably belongs to the same species of lesion. All the above mentioned modes are applicable to them; but when a radical cure is to be obtained recourse must be had to excision, either simple or aided by cauterization, or to extirpation.

A wound of the salivary ducts may also give rise to tumors of this nature, even over the course of the duct of Steno. M. Verhnes, of Tarn, has recently

made known an interesting example of it: in consequence of traumatic lesion there arose on the inside of the cheek a small oblong tumor filled with saliva, which M. Verhnes succeeded in curing by passing through it a small trocar, carrying with it a double gold wire which he employed as a seton. If a similar case should present itself, the practice of this surgeon should be imitated; at least, if we are unwilling to simply trust to the process of Beclard in salivary fistulæ, or rather to the treatment applicable to ranula.

Art. 3.—*The Tongue.*

§ 1. *Tied Tongue.*

The species of fibro-mucous fold which fixes the free portion of the tongue to the posterior face of the chin, and which is called frænum when its dimensions are well proportioned, takes the name of *filet* when it is too long antero-posteriorly, or too short perpendicularly. The child in this case finds it impossible to suck. The point of the tongue being arrested against the inferior limits of the mouth, cannot be brought without to seize the nipple. It is, therefore, a disposition which might have serious consequences if not immediately remedied. Yet we should be cautious in deciding that the child has a *filet* when it does not suck, or when it is slow in speaking. Such accidents, which might be produced by a thousand causes, do not depend on the frænum of the tongue, if the finger when passed into the mouth can be seized by it, and if it is possible for its point to arrive at the lips; and it is only in the contrary case that the division of the filet is to be thought of.

History.—Nothing indicates, unless it be an expression of Cicero, that this trifling operation had been described before Celsus, who in performing it lifted the tongue with forceps, and recommended caution in not cutting the vessels. Instead of forceps, Paulus Egineta and Abul-Kasem used a hook, the more certainly to avoid hemorrhage. Avicenna traversed the base with a ligature, and thus dispensed with a cutting instrument. De la Cerlata, who blamed midwives for tearing it away or cutting it with the nail, destroyed it with a peculiar instrument, raising the tongue with two fingers. The pointed scissors of Friederich are justly rejected by F. ab Aquapendente, who inveighed against the evil custom of matrons, already condemned by De la Cerlata. After raising the tongue, J. Fabricius seized the filet between two fingers, and divided it with little strokes of a curved bistoury, and says moreover that this operation is rarely indispensable. De Hilden is of the same opinion, and performed it with a cleft instrument which served at the same time as scissors and a fork to support the tongue. The blunt fork and the large scissors invented later by Scultetus and Solingen, are useless. The idea of dividing the filet with a red hot bistoury, as performed by Lanfranc, would at the present day be ridiculous. The springed instrument of J. L. Petit, praised by Platner, appeared unsuitable to Le Dran, who maintains that blunt scissors are always sufficient, and that it is superfluous to tear the wound with the finger to enlarge it when the incision has been made, as Dionis did. The cleft spatula of Richter and Callisen, the curved and blunt scissors invented by G. Schmitt, are not in use amongst us, although they may very well attain the end proposed by their authors. Always ingenious

in constructing new instruments, M. Colombat has just proposed one which seems to me entirely useless, as well as the excision which he wishes to substitute for simple incision.

Operation.—The method of Le Dran is now followed; that is, the child being placed with its head bent backwards against the nurse, or some other person who will not be intimidated by its cries, the surgeon raises the tongue with one or two fingers of the left hand, while with the other, armed with blunt scissors, he rapidly divides its frænum. But as the volume of the fingers often hinders the rest of the operation, there has been generally adopted, since J. L. Petit, a grooved sound, the plate of which being split supplies their place, and at the same time protects the vessels. When the filet is well engaged in the bifurcation of this plate, the operator raises its body a little towards the forehead of the child, so as to throw the tongue backwards and upwards; he then introduces his scissors beneath, and with a single stroke cuts the membrane thus stretched, taking care to direct the point of the instrument a little downwards, to be more sure of running no risk of touching the raninal arteries. The wound requires no attention, and it is extremely rare that the little patient suffers from it for more than a few hours. The motions of the organ prevent agglutination, and on this point I do not see the necessity of touching with the nitrate of silver, as advised by M. Hervez, of Chegoin. Tetanus, which resulted from it in the child spoken of by J. Fabricius, who had been operated upon by a quack, has never been observed since. According to some authors, two serious accidents, hemorrhage and inversion of the tongue into the pharynx, may be manifested after the section of the filet. The first happened to Roonhuysen himself, who could not arrest the bleeding but by inserting vitriol into the bottom of the wound. Maurain ran still greater risk; he had to resort to the actual cautery. J. L. Petit cites two cases in which the operation had been badly performed, the subjects of which would evidently have died if instant relief had not been afforded. A circumstance which aggravates the danger in this case is, that instead of being spit out the blood is swallowed as it flows, and if not watched the child may sink before the cause is discovered. By using the sound, and the precaution to cut nearer the floor of the mouth than the tongue, it is almost impossible that such hemorrhage should take place. If it does, however, it may be arrested by applying to the bleeding point the head of a stylet heated to whiteness; or, as practised by J. L. Petit, by means of a fork of wood an inch long wrapped with linen, resting against the internal face of the maxillary symphysis with one part and embracing with the other the apex of the wound, while a small bandage passed across within the mouth, brought back, then crossed below the jaw, and carried up over the ears to be fastened to the child's cap, prevents motion of the tongue. Two small blades united in the middle in the form of pincers, with which the bleeding part is seized, and which is made to act by pushing a wedge between the two portions of its other extremity, will accomplish the same end, and attain it with even still more certainty. The natural softness of the tissues and the retraction of the arteries, will in general render the ligature recommended by Courtois altogether inapplicable

As to *Inversion*, the moderns scarcely admit its possibility. J. L. Petit, who witnessed three examples, explains it by saying that the frænum being

once cut, the tongue becomes free and is turned back and directed towards the throat with the more facility; as the child, which until then could not take the breast, sucks it with a kind of voracity. In one case, this practitioner drew it three times from the pharynx; but at the fourth the patient died for want of relief. J. L. Petit has *seen* the inversion during life, and *verified* its existence after death; it is a fact therefore undeniable. I do not see, besides, why it is so difficult to comprehend, or why there is any question of what travellers relate of those orientals and negroes, who, to avoid too severe chastisement, cause their own death by swallowing their tongue. It may be prevented by not carrying the division of the frænum too deeply. To remedy it, we must with the finger bring back the tongue to its natural situation, and cause the child continually to suck while there is danger, and when it does not suck, to keep the tongue down with the bandage just mentioned in speaking of hemorrhage.

§ 2. *Anchyloglossis.*

Adhesions of the tongue to the mouth have always attracted the attention of surgeons. Whether congenital or acquired; the result of simple inflammation or produced by more extensive lesions; whether recent or of long standing, the knife is the only means of overcoming them. Aetius says, the abnormal membrane or cicatrix is to be seized with a hook, and divided with all necessary precautions. Towards the middle of the seventeenth century, J. Hellwig, being consulted by an individual who could not articulate, destroyed by dissection the adhesions of his tongue, and thus restored him to speech. In our days the practice is not different; but we must be cautious not to be deceived by a disposition sometimes met with in infants. The tongue is then merely pasted as it were against the palatine vault, as witnessed by Louis, or to the floor of the mouth; which has caused more than one gossip to suppose that the child had no tongue. The finger, the handle of a scalpel, or a spatula, is always sufficient to destroy this simple agglutination, which perhaps is in reality the commencement of a true anchyloglossis. The conduct to be observed with adults is the same, if we are called before the adhesions, resulting from extended inflammation, have acquired any considerable firmness.

1. If there are but a few small filaments on the sides of the frænum, they are divided the same as the filet with scissors, and with the same precautions. We divide in the same manner those which are not unfrequently established between the cheeks and the margin of the tongue, in consequence of mercurial inflammation of those parts; as also of other phlegmasiæ of the mouth, examples of which have been communicated to the Academy by Messrs. Duval, Cullerier, and Bernard. If they are of some breadth, they should be excised instead of being simply divided. After having been detached from the buccal wall by a stroke of the scissors, they are again taken hold of near the tongue, and removed by a second stroke of the same instrument. They may likewise be removed by seizing each in its turn about the middle with forceps, while the edges are detached with scissors or the bistoury.

2. When these adhesions are intimate, or as they are termed, cellular and not membranous nor filamentous, the dissection has to be performed with

great management and precaution. The surgeon, placed behind and at the right of the patient (whose head is bent against a pillow, the arm of a nurse, or the breast of an assistant), tries to separate by means of the left index finger, a spatula, or some appropriate instrument, the free part of the tongue from the point of the mouth to which it is attached; he divides gradually with a straight bistoury, chipping as it were all the lamellæ and all the unnatural ligaments which it is intended to destroy, recollecting, at the inferior region especially, to incline the edge of the knife towards the wall of the mouth, or to separate it as much as the state of the parts will admit from the body of the tongue itself, in order more certainly to avoid the vessels; to have the blood sponged as it flows during this dissection; to stop from time to time to allow the patient to breathe and gargle, and if there be hemorrhage to cauterize with heated iron; in other cases he is to prescribe some styptic or astringent wash; and concludes by passing his finger over all points of the wound to satisfy himself that no prejudicial adhesion exists. Mild gargles, frequent and extensive motions of the tongue, carrying the end of the finger between the divided surfaces to prevent readhesion, are all that remain to be advised for completing the cure, which is generally effected from the fifth to the thirtieth day, but which requires all this attention to be certainly accomplished.

§ 3. *Excision.*

History.—Gangrene, induration, fungous tumors, schirrus, and cancerous ulcers, are the principal affections which may require extirpation of the tongue in whole or in part. This is an operation which has but lately entered into practice. From the idea that the tongue is the exclusive organ of speech, although J. Lange is said to have performed it several times on account of gangrene, such a resource was only thought of with trembling before Louis showed that many individuals deprived of a great part of this organ have continued, nevertheless, to speak and appreciate the taste of substances. The laborer spoken of by Roland of Saumur, who had lost his tongue as far as its root in consequence of gangrene, spoke, spit, and swallowed without difficulty, and had perception of tastes; the girl, observed at Lisbon by De Jussieu; Margaret Cuting, mentioned in the Philosophical Transactions; Marie Gulard, quoted by Bonami and Louis; the girl, A. M. Federlin, whose story was made known by Auran; the young man whose tongue was torn out by the corsairs because he would not become a mussulman, and whom Tulpius affirms that he saw; and another, observed by Zacchius, who had had his tongue cut out by robbers, were in the same case. It is known, besides, that in Germany, Italy, Spain, &c., malefactors were for a long time punished by cutting out the tongue, and that for the most part they still preserved the faculty of speech. Every one, in fine, is acquainted with the two cases related with so much simplicity by A. Pare; first, of a mower who had been dumb for three years from having lost a portion of his tongue, and being tickled by one of his comrades while holding a vessel between his teeth, made an effort, and to his great surprise uttered several words; and beginning from this adventure learned in the end to speak distinctly with his porringer or a little cup of wood: second, a youth whose tongue had been cut out, recovered

his speech by making use of the instrument invented by the above mentioned mower. But if it is well proved that the loss of the tongue is not always followed by complete loss of speech, it is no less proved that its amputation has more than once been performed without very evident necessity. It is dispensed with at the present day, for example, and Pimpernelle is not imitated, although the organ be so swelled as to cause it to protrude, unless there is also a true scirrhous or cancerous degeneration.

Manual.—The operation is conducted in different modes, and must vary according as the disease occupies one portion more than another. Hooked forceps and curved scissors are sufficient for the excision of *pedunculous tumors*, which seldom occur except on the dorsal face of the tongue. The ligature would not have the same advantages; and to prevent any doubt of having removed the whole, it would be well to sear the bottom of the wound with a hot iron. If the alteration is confined to the *tegumentary layer*, which, it may be remarked, is much more common than is thought, it will be requisite, as proposed by Lisfranc, and as Walens, in imitation of Bartholin, seems to have practised long since, only to remove the degenerated laminæ, and to spare with prudence the fleshy tissue which ordinarily remains sound. When the cancerous ulcer is deeper, and situated on the edges, the curved bistoury is no longer used to destroy it, as by the surgeon mentioned by Ruysch. The point of the tongue, wrapped with a dry cloth, is drawn out by the hand of an assistant, who inclines it to the side opposite the disease. The operator, armed with a straight bistoury, commences by an incision of several lines on the inferior face and along the whole length of the organ; he then makes another upon the dorsal surface, and thus includes the cancer and even a certain portion of the sound parts; then lifting it with the forceps or hook, promptly completes its excision. Actual cautery, without being absolutely required, may become necessary in the end, as in the preceding case. When the disorganization is of greater depth; when especially it extends further backwards, and when besides it appears possible to save one half of the tongue, we may be allowed to think of the ligature which M. Mayor, of Lausanne, calls the *ligature en masse.* It will be more secure from hemorrhage than the bistoury; and, applied in a certain manner, nothing prevents its being carried to the neighborhood of the larynx. The process of this surgeon is one of the most easy. The organ is first transpierced from beneath upwards and from before backwards, at its most remote part with a good bistoury, which being drawn forwards divides its whole length into two equal parts without touching the neighboring arteries. The operator then carries a noose of strong cord of threads over the affected division, to a point beyond the disease; passes its two ends *separately* into a metallic head of a square shape and pierced with two openings slightly convergent; then, *together*, through four, five, six, seven, eight, or nine balls of the same nature pierced with a single hole, as the beads of a rosary, and finally through a canula designed to support and push forward these beads, and which itself is to be supported by a tourniquet or little axle, on which the extremity of the ligature is fastened. Having thus embraced the base of the flap which is to be destroyed, he turns the little axis, and when the constriction is carried sufficiently far, fixes the free portion of the apparatus to the labial commissure either by means of a thread or with a small bandage. Daily, and even several times during the day, pressure is increased in the same

manner. The tissues become blackened and soon mortify and fall off, or may be excised without danger on the third or fourth day. The serre-nœud of M. Mayor, a real improvement of the instrument devised by Messrs. Bouchet and Braun, has the advantage in consequence of its flexibility of moulding itself without difficulty to the inequalities of the tongue, and of occasioning but little obstruction in the interior of the mouth, and of allowing a constriction at the same time gentle, firm and permanent. When it cannot be had, the serre-nœud of Desault, or that of Levret, may be here employed as well as for the ligature of polypi in general. If the whole breadth of the tongue is to be removed only at its point, or even near its base, the ligature will still be applicable. The confirmation of this is to be found in the observations of La Motte and Godard, each in a different case. Sir Ev. Home and Mirault passed a double ligature through the centre, and brought its two portions to be tied on the sides of the organ, which was thus divided, and dropped off by suppuration. But whenever the *tumor does not extend too far backwards*, and a little sound tissue is found on its edges, *excision* with a cutting instrument is preferable. Louis, like the ancients, after having seized it with a hooked forceps, such as the forceps of Museux, performed the amputation of the tongue by cutting it fairly and simply across with a bistoury. At present a much more rational process is followed. Having seized the morbid mass with a strong hook or hooked forceps, the surgeon with one hand draws it out of the mouth, and with the other circumscribes it, and removes it with two strokes of the scissors from the sound parts, in the form of a V, the point of which looks backward and should fall upon the median line; he immediately approximates the two sides of the wound and unites it by three stitches, one on its dorsal surface, the second at its point, and the third on its inferior surface. Its agglutination is often complete by the second day; the threads may be brought away on the third or fourth day, and the cure is generally complete about the eighth or tenth: such at least are the observations of M. Boyer, M. Langenbeck, &c. By this mode the deformity is as little evident as possible, and the exact coaptation of the bleeding surfaces soon arrests the hemorrhage enough to render unnecessary the employment of any other hæmostatic means. Transverse amputation ought therefore to be reserved for cases which leave no chance for the formation of lateral flaps. Every tumor, whether scirrhous or carcinomatous, which does not penetrate too deeply, and which is prominent at the periphery of the tongue, may be easily destroyed by the process of Faure or of Louis; that is, with curved scissors or the actual cautery. Those which penetrate to the fleshy tissue and are situated on the surface or one of the edges without going too far backwards or invading the whole breadth or thickness of the organ, require on the contrary the use of the bistoury by the process which I have pointed out, and which approaches a little the method of P. le Memnonite. If the disease, although very extensive in surface, remain superficial and leave the tissues sound beneath it, we must follow the indication pointed out by Walee, imitate Lisfranc, dissecting and removing what is diseased, and respecting and preserving what is not. If it be necessary to destroy an entire half of the tongue including its base, the ligature of M. Mayor is applicable, and in my opinion to be preferred. While, if it become necessary to remove the whole, the process of Mr. Home has the advantage; as well as

in all cases in which excision, after the manner of M. Boyer, is not sufficient to remove the tumor or central change of structure.

After Treatment.—It is extremely rare that after any of these several operations there is need of dressing or apparatus. But in the contrary case the pocket of Pibrac would be useful. It is a little purse destined to lodge the free or movable portion of the tongue, and may be lined with lint or any other piece of dressing. The two branches of silver which sustain its base, and support each a riband at its free extremity, are bent in such a manner, that by drawing upon what remains without the other portion is forced to enter the mouth. Supposing a perplexing hemorrhage to supervene, a hemorrhage which the resources pointed out above shall not definitively arrest, recourse must be had to the ligature; then the lingual artery is to be sought for at its passage over the os hyoides, unless it be thought best to tie the carotid itself. It would even be prudent to begin with this, if the tongue is to be amputated near its root with a cutting instrument.

Art. 4.—*Isthmus of the Fauces.*

§ 1. *Excision of Part, or the Whole of the Tonsils.*

History.—After repeated inflammations, the tonsils often remain so large as to impede deglutition, hearing, and even respiration. The hardness which they at the same time acquire, has for centuries given rise to the opinion that they pass to a schirrous state. But since the time of Claudinus, and more especially of B. Bell, the falsity of this opinion is generally admitted; although to my surprise I find it advanced in the recent work of Messrs. Roche and Sanson. Every surgeon at the present day, knows that the induration of the amygdalæ with swelling is but an hypertrophy; and that it seldom or never gives place to scirrhus or cancer. The treatment to which it has been submitted has been very various. Without counting scarification, which was recommended by Asclepiades the Bithynian, Heister, Maurain, Celsus, and some moderns, it has been treated by cauterization, ligature, extirpation, and excision.

1. *Cauterization.*—Mesue, who appears to have been the first who dared to apply caustics to the tonsils, made use of the actual cautery. Brunus followed the same practice, at least when he intended to destroy the whole of the disease. Mercatus, who comes later, adopted a golden cautery moderately heated, which he carried through a canula to the tonsil to be burned. M. A. Severin, less particular than Mercatus, was content with an iron instrument, and used it the same as Affisius his friend, only upon tonsils with a broad base. After saying that Ed. Mol cauterized the tonsils very successfully by piercing them repeatedly with a hot iron, Wiseman still admits that he prefers the use of escharotics, which Junker, Heister, and Freind advise under different forms. The lapis infernalis, employed successfully by Morand, is still sometimes used; but it is not useful, nor are the sulphates of iron, of copper, or of alumine, except in cases of recent or inconsiderable induration. Red hot iron, which Louis appears to have partially adopted, is prefer-

able when there is need of free and energetic cauterization; but is evidently applicable only to fungous and cancerous tonsils, except in cases where it is feared that some part is left which ought to be removed, that the disease will be renewed, or the blood escape too plentifully after excision. But as these different circumstances, pointed out by Percy and Boyer, are rare exceptions, it follows, even receiving them as facts, that cauterization should scarcely ever be admitted.

2. *Ligature.*—Devised to avoid hemorrhage with certainty and excite less apprehension in the patient, and employed for a long period in France, the ligature had yet been clearly prescribed by no one before Guillemeau, who in applying it made use of a kind of serre-nœud forceps, very ingeniously arranged. F. de Hilden is the second author who recommends it. The canula, supplied with a grooved ring which he had invented for this purpose to carry and fasten the thread, has not been more generally adopted than the instrument of Guillemeau. Cheselden, who was one of its principal partisans, applied it by means of a simple probe when the tumor was pedunculous. In other cases, with a curved needle he passed a double thread through the gland, in order to strangulate each half separately. Sharp operated exclusively in this manner, which Lecat, after Castellanus, Levret, and Heuermann modified, particularly in using threads of different color, so that it was impossible to confound them. Bell took a silver wire or a piece of catgut; fixed it in a canula slightly curved, which he carried to the superior part of the pharynx through the corresponding nasal fossa; then enlarging the noose with his finger placed it around the tonsil, and used his canula as a serre-nœud. A thread of Brittany carried through the mouth on a double hook, and fixed by means of his ordinary serre-nœud, sufficed with Desault. Heuermann maintained that the polypus instruments of Levret answer best for this ligature, which may be equally performed with the chaplet-shaped instrument of M. Moyer, or in imitation of C. Siebold, by means of a silver wire conveyed with forceps. The disadvantages of the ligature, already remarked by Van Swieten and Moscati, are obvious to all, and are so inherent in the operation itself, that no one now employs it, notwithstanding the success attributed to it by Dr. Physick; and we can scarcely comprehend the efforts made recently in England by Messrs. Chevallier and C. Bell to restore its use.

3. *Extirpation*, which Celsus seems to mean by these words: *oportet digito circumradere (tonsillas) et evellere*, has been positively prescribed by Paulus Egineta, *ipsam totam (tonsillam) ex fundo per scalpellum resecamus)*, who performed it with a curved bistoury. Ali Abbas invented for this purpose a kind of hook which he called *senora*, and Abul-Kasem a small knife in form of a sickle. Instead of the *ancylotome* of Paulus, J. Fabricius advises first to insulate the gland with an elevator, then to seize it with the forceps and draw it dexterously forward, so that it shall yield without difficulty, and as of its own accord. It may be possible, strictly speaking, to extract the amygdalæ by enucleating them with the nail and the finger, as it probably was done in the time of Celsus; but this would be to increase unnecessarily the sufferings of the patient, and it is evident that such an eradication must be dangerous. For the rest, extirpation of the tonsils is entirely useless; rescis-

sion has for a long time superseded it. If however it is to be tried, nothing can be more simple. A hook, or the forceps of Museux, to draw forward and disengage the gland from between the columns of the velum palati, and a narrow probe-pointed bistoury to cut its roots, will suffice as in ordinary excision. Care however must be taken not to go beyond the lateral limits of the pharynx, else the venus plexus or some still more important vessel, the carotid for example, which is found on the sides of this muscular funnel, may be wounded, and thus cause a formidable hemorrhage.

4. *Excision.*—Although Aetius is the first who formally declared that only the projecting portion of the tonsils should be removed, and that its extirpation was never necessary, yet rescission had been recommended before his time. The operation which Asclepiade designates under the name of *homoirotomie* can be nothing else. And has not Celsus also described it in this phrase? *Si ne sic quidem resolvuntur, hamulo excipere et scalpello excidere.* Those who have admitted it since, have nearly all attempted to modify more or less the method of performing it. Rhazes says that the tumor is to be seized with a hook, and one-fourth of it to be cut off; but, according to him, it is so dangerous an operation that it is better to have recourse to bronchotomy. Instead of the hook and ancylotome of the ancients, of the curved bistoury and double hook of Mesue, Wiseman begun by tying the tonsil, and then used the thread as a hook while he excised the gland with scissors. Heister, as well as Mesue, speaks of a double hook and bistoury. Moscati, who was at first the partisan of the ligature already proscribed by Cavallini, and who afterwards practised excision with a curved bistoury fixed on a slip of wood, adopted a different process: he began by incising the tonsil crucially with a convex bistoury, after which he cut off its four portions separately, leaving intervals of three or four days between the operations. Maurain, who justly criticises the method of Moscati, prescribes, like Levret, that the whole protuberance be taken off at a single stroke with curved scissors made expressly for the purpose. Lecat returns to the double hook of Heister, and advises a small concave knife with a blunt point, or curved and blunt scissors. At the same epoch Foubert recommends the gland to be embraced with polypus forceps, and pressed forcibly in order to contuse the vessels, while the excision is performed by a single stroke of the bistoury. Caque, of Rheims, boasts very much of a simple hook and a blunt pointed knife, with an edge nearly straight and bent upon the handle. Louis asserts that the ordinary bistoury will serve the purpose, and that if the gland is cut from below upwards, it will certainly prevent its falling into the opening of the larynx and exposing the patient to suffocation, as in the cases which excited so much apprehension in the minds of Wiseman and Moscati. With this view another surgeon o Rheims, Museux, invented the forceps which bears his name, and maintains that the tonsil once seized by this instrument cannot possibly escape, and that nothing is then easier than its excision either with scissors or the bistoury. Desault preferred the ordinary double hook and the *kiotome*, a kind of flat canula six inches long by one broad, deeply hollowed out at its extremity, to receive the tonsil, enclosing a movable blade, cutting at the point which traverses the hollow of the sheath, and acted upon by the thumb. This instrument of Desault, although ingenious, is no longer used, at least in France.

A narrow bistoury, straight and blunt pointed, such as is found in every surgeon's case, is much more convenient, and, as M. Boyer observes, merits preference in every respect.

Appreciation.—Authors have differed so much in the manner of performing an operation so simple, only because in indocile subjects, children for example, and those who have a small deep mouth, or where it is opened with difficulty, it often presents great difficulties. A glance at the several stages of the operation will permit us, I trust, to reduce to their true value the principal assertions of the operators who have just been quoted. The first thing then to be done is to keep the mouth of the patient open and govern the motions of the tongue. Hence the various glosso-catoches of the ancients, and the numerous species of *speculum* which have succeeded each other from the time of Ambrose Pare to our own; hence the *chevalet*, the handle of which, curved like an S, enabled Caque to draw back the labial commissure and keep the jaws apart; the plate of silver, which was applied on the tongue, while its handle, a little more elevated, rested upon the inferior dental range, which it depressed; the other more complicated instrument, proposed by M. Lemaistre at the Hotel-Dieu, afterwards by M. Garnier to the medical society of emulation, which, without obstructing the movements of the operator, was to keep the mouth steadily open and the tongue depressed; the blade of box or ebony bent at a right angle, much resembling for the rest a shoeing horn, and which is regarded by Messrs. Roche and Sanson as very advantageous; hence again the instrument, at the same time more complete and more complicated, of M. Colombat. But a spatula, or the handle of a silver spoon and a piece of cork, are of equal avail and less embarrassing than any of these ingenious inventions. The preliminary ligature of Wiseman is evidently an episode more vexatious than excison itself. As to the hook, it is to be feared, that if single it will tear through the tissues and escape; and if double, it may be too difficult to disengage it, and particularly if quadruple, as in the forceps of Museux. It is objected besides to these last that they impede by their volume the play of other instruments, and that they are not easily borne by the patient. In fine, the three-pointed hook, devised by Marjolin on the occasion of a young subject difficult to manage, would prove still more embarrassing than the instrument of the surgeon of Rheims, if it should become necessary to withdraw it before the end of the operation. These objections, no doubt, have some foundation, although the greater part of the disadvantages pointed out are very trifling. After all, the choice of the hook is not an important affair. Provided the single hook has a certain degree of strength, its curve a certain extent, and that it seize the gland behind at the union of its external third with its internal two-thirds, it will allow of traction with as much force as the double hook, and will not lacerate the tissues more. Neither Louis nor M. Roux has found in it any thing to complain of, and for my own part I have always found its use very convenient. For the rest, the double hook employed by Desault, and which is now daily used by M. Boyer and many others, has in my opinion only the disadvantage of being somewhat difficult to place. The forceps of Museux, preferred by M. Dupuytren, although less easy to handle, present an advantage which is not found in the hook of M. Marjolin—that of not being liable when withdrawn to wound the parts within the mouth.

As to cutting instruments there is no choice except between the scissors and the probe-pointed bistoury. With the former there is less danger (especially by selecting scissors with blunt points, or buttoned and curved in the flat) of dividing what it is necessary to preserve. But the division is less neat, and they occupy a little more space in the pharynx and mouth than the bistoury. When pressed between their blades the gland sometimes retreats, and requires to be divided at several strokes. With respect to the bistoury, the reason for excluding all but the probe-pointed is that the others will almost infallibly wound the posterior wall of the pharynx, the external side of which it would also be very easy to penetrate. The knife of Caque is too large; the narrower and straight bistoury is undoubtedly the best that can be employed. If the kiotome had not been recommended by a man as celebrated as Desault, and regarded in so advantageous a light by Mr. S. Cooper, it would scarcely deserve to be mentioned. The instruments being selected, it remains to be considered how we shall perform the excision. By cutting from above downwards, as advised by some, there is reason to apprehend that the bistoury will wound the base of the tongue, and if only held by a pedicle, the gland may escape and fall upon the larynx; but then it would be so easy by carrying the finger into the fauces to bring it through the mouth, that the accident which was on the point of happening to Wiseman and Moscati, is in reality scarcely to be feared. Louis, who dreaded it, says that by cutting from below upwards nothing of the kind is to be apprehended, and the tongue will be out of all danger of being touched. Admitting the justness of this principle, Messrs. Boyer and Marjolin have nevertheless thought proper to adopt it only in part. According to them, if there is no danger to the tongue it is otherwise with the velum palati, and to avoid all risk to this part they follow the advice of Richter, cutting first from above downwards, then from below upwards, and conclude with the middle portion of the tumor. There is nothing to censure in this excess of precaution, except its inutility. M. Roux operates generally like Louis, and finds the method sufficient; and I have no reason to regret having done the same. If care is taken to make the tonsil project sufficiently by drawing it forward, and to rest a little of the flat part of the instrument against the columns of the pharyngeal isthmus, as if to shave off its curvature, a much neater and quicker section is obtained there without any real cause for apprehension.

Manual.—The patient is seated on a chair fronting a window, so that the light may fall directly upon the bottom of the fauces, while the head is held back by an assistant. Placed in front, the surgeon fixes a cork, shaped for the purpose, as deeply as possible and vertically between the molar teeth of one side, so as to keep the jaws separated; he depresses the tongue if it is in the way, and draws out the commissure of the lips; catches the tonsil and engages it firmly from behind with his hook, using the left hand for the left side and the right hand for the right; he pulls it forwards and disengages it from between the columns; takes in the other hand the bistoury, enveloped with a linen fillet to within ten to fifteen lines of its point, carries it between the hook and the tongue beneath the base of the gland, turns its edge upwards, and cuts freely by a sawing movement, as if to make it describe a segment of a circle which will terminate at the base of the uvula, and thus detaches all the superfluous portion of the tumor at a single stroke; he then withdraws at once the bistoury, the

hook, and the excised mass, relieves the jaws of the cork which fatigues them, lets the patient spit, and gives him cold water or vinegar and water to wash and gargle his mouth. If only one tonsil be affected, the operation is over; if both, he lets some minutes elapse, the blood ceases to flow, and he proceeds to the excision of the other in exactly the same manner. Several days may be permitted to intervene, if the patient, being fatigued, absolutely requires it; but in general they choose to be relieved at one sitting rather than to return to it at separate periods, and the pain they experience is commonly so trivial that they submit to it without much apprehension.

After Treatment.—If the blood is not soon arrested, a solution of alum, water of Rabel, or any other styptic liquor, may be immediately given as a gargle, or applied to the wound alone by means of forceps, if it should be necessary to use it energetic and very concentrated. In case of imminent danger actual cautery forms a last resource, which must not be neglected, and which is much more efficacious than the complicated compression proposed by Jourdain. In an adult, upon whom I operated in the beginning of 1831, at the house of Madame Reboul, the loss of blood at the end of two hours was such that it was necessary to apply powdered alum immediately to the wound. If a bungler had opened the carotid, as M. Portal, A. Burns, and Beclard say they have seen, the ligature of the primitive trunk would still offer some chance of safety. For the rest, the medical treatment consists of emollient gargles and diluent drinks, and the regimen of soups, broths, and afterwards a little more substantial aliment. Generally no fever supervenes, and from the fourth to the fifth day the health is in a great measure re-established.

§ 2. *Abscess; Incision of the Tonsils.*

The surgeon is sometimes obliged to open with an instrument abscesses which form in the substance of the tonsils, in consequence of phlegmonous inflammation. The sharpened iron of Hippocrates and Celsus, the long bistoury and needle used by Leonidas, the razor of Lanfranc, the small piece of polished wood of Plater, the sagittella of Arculanus, the beaked bistoury invented by Vigo, the pharyngotome of J. L. Petit, that of Jourdain, and the lancet of Roger of Parma, are all advantageously superseded by the ordinary bistoury in this trivial operation. Pressure with the finger or the nail, or an emetic opportunely administered, very frequently suffices. The mouth and the patient are disposed as in excision of the tonsils, and the bistoury is to be wrapped with a bandage until within six lines of its point, before it can be allowed to be plunged into the abscess. The opening of abscesses which are sometimes developed in the substance of the velum palati, the uvula, or even the base of the tongue, is performed with the same precautions and requires no further care.

§ 3. *Excision of the Uvula.*

The elongation of the uvula, whether from infiltration, inflammation, or organic degeneracy, is a condition which received much more attention from the ancients than from the moderns, and perhaps deserves more consideration than is generally accorded to it at the present day. From its contact with

the base of the tongue, the apex of the uvula produces a very inconvenient tickling, and sometimes gives rise to symptoms which seemed to belong to much more serious causes, gastritis and phthisis for example, and which may lead to serious errors of diagnosis; as well as of therapeutics, if the surgeon is unacquainted with their peculiarities. Consequently, it is important that there should not be too much delay before applying a remedy to alterations of the uvula; and its removal, it is to be remembered, as proved by Physick, Beckern, and Lisfranc, is the only means of removing certain obstinate symptoms which are apt to be mistaken for more serious affections.

1. *Cauterization.*—The inflammation of this part, even when acute, yields readily to cauterization with nitrate of silver, when not too far advanced. I have used it, like M. Toirac, in many patients, and found in it nothing but what should meet with approbation. The mixture of quick lime, tartar, alum, and vermilion, praised by Demosthenes, and the caustics in general proposed by Galen, are at most applicable to cases of serous infiltration. The cauteries of gold or iron, used by Montagnana and Arculanus, the nitric and sulphuric acids, proposed by Vigier and Nuck, are now justly bandoned. No one at the present day would follow the ridiculous advice given by Mesue, afterwards repeated by Nuck and Bass, which is, to pull the hair to the point of tearing the skin from the cranium and tie it with a ribbon near the base, after forming it into a toupet.

2. *Astringents.*—Sal ammoniac, nut-galls, according to S. Largus; walnut-shells, according to Galen; burnt alum, to Rhazes, and pepper and ginger, still recommended by Purmann, are scarcely used at present, except by old women and country people, who, when the *palate is down*, think also to raise it by passing beneath it a silver spoon considerably heated.

3. *The Ligature*, carried round the base of the organ by means of the grooved ring of Castellanus, as Pare directs, with the porte-ligature of F. de Hilden and Scultetus, or in any other way, without being as dangerous as Dionis pretends, is nevertheless unnecessary; and excision with a cutting instrument is the only means which is now opposed to chronic lesions which have produced the elongation, or what is termed the fall of the uvula.

4. *Excision* is an operation, moreover, which has been practised in every age and in various modes. Hippocrates treats of it, and directs it to be performed with dexterity. Celsus and Galen followed the same process. Paulus had instruments express—a *staphylagra* to hold the organ, a *staphylotome* to cut it, and a *staphylocaust* to cauterize the wound. He mentions still another instrument, invented by Serapion. Mesue, who forbids the uvula ever to be cut away entirely, excised it with a golden bistoury reddened in the fire, after having engaged it in the ring of a sheath made for the purpose. In place of this sheath, G. de Salicet directs the employment of a tube of elder, in which he placed the uvula to divide it either with hot iron or the bistoury. Guy de Chauliac advises forceps or a hook, a concave bistoury or scissors. The scissors, without forceps or hook, were sufficient for Fabricius, who then cauterized the wound to recal its vitality. A Norwegian peasant, Thorbern, invented an instrument in part similar to that of Mesue and Arnaud, that is, a kind of kiotome, which opens to engage the uvula in a circular hole near its extremity, which has only to be closed to complete the operation. Job a Mekren, who saw the uvula extend to the lips, is of opinion that nothing can be

employed more convenient than scissors with long blades. The instrument of Thorbern, improved by Raw, soon after reproduced by Bass under the form of a spatula furnished with a cutting tongue, did not prevent Fritze from making further modifications. Levret, who was also a partisan of the ligature, has extolled scissors with concave edge (as for the tonsils), and the polypus forceps. Richter found that scissors with blunt points served his purpose very well; and B. Bell adopted a curved bistoury, probe-pointed, and nearly similar to that of Pott for hernia. But the scissors of Percy are the most ingenious and the most simple for the excision of the uvula. A prolongation of three or four lines, bent at a right angle, terminates one of their blades, and prevents the organ slipping before them when once it is engaged. Their only fault, as well as that of most of the instruments mentioned above, is that they are not indispensable and can answer no other purpose; whence it follows, that the new staphylotomes recently invented by Messrs. Rousseau and Bennatti are also superfluous instruments.

Manual.—The patient is seated as for excision of the tonsils. With the left hand armed with a fine hook, dressing forceps, or, still better, polypus forceps, which from the notch or opening at their extremity will retain it still more securely, the surgeon hooks the uvula; inclines it forward and a little to the right; then with straight blunt scissors cuts it by a single stroke at some distance from its base. It is not with the vain purpose of preventing its falling into the larynx that we first endeavor to fix it, but, being very pliant and movable, it would otherwise escape from the blades of the instrument. Oribasius, Rhazes, Avenzoar, &c., are mistaken in saying that its entire removal is dangerous, and that it always affects respiration and the voice. S. Braun is still further from the truth when he asserts that it constantly produces dumbness. The case quoted by Wedel, and which tends to prove that food and drinks return by the nose, is evidently only an exception. The observations of Scheffer, Becken, Myrrhen, and Physick, fully demonstrate that the loss of this organ rarely produces any disturbance in the system. It is better to remove too much than too little, so as not to be obliged to repeat the operation. Besides, the resolution of the inflammatory engorgement which soon commences causes the uvula, whose base had been more or less concealed in the velum palati, to be found much longer than at first there was reason to expect.

§ 4. *Staphyloraphy.*

The abnormal divisions of the velum palati are, as in the lips, sometimes congenital and sometimes acquired. That the first occupy nearly always the median line is owing to the palatine vault not being completed posteriorly, and its two portions not united at the usual period. Yet they are found sometimes a little on one side, but have never yet been seen double. The second, an ordinary result of traumatic lesions, and more particularly of syphilitic ulcerations, are met with on the right and left as well as in the middle, and in the form of hollows whose depth is usually limited by the edge of the vault, while the other kind often extend to the dental range, so as to be continuous with a hare-lip, simple or double, if the patient is simultaneously affected with that disease.

A. *History.*—Nothing from the ancients indicates that they had thought of overcoming this defect of conformation. More enterprising or more skillful, the moderns have attempted to fill up this chasm, and their efforts have been crowned with the greatest success. Casting the eye upon a fissure of the palate, the idea of staphyloraphy must have presented itself a thousand times to the mind; but to think of it was not all—the application of the idea was to be prosecuted, and no one had ventured. The attempts which M. Colombe says he had made since 1813, on the dead body, and wished to repeat in 1815 on a patient who refused, have not been known to the public; that of which M. Græfe has published the details in Hufeland's Journal for 1817, and which he dates back to the end of 1816, passed equally unnoticed. It was then reserved for M. Roux to fix attention on this subject. In 1819, a young American physician, Dr. Stephenson, gave him the first opportunity. The operation succeeded to his wish, and formed a kind of epoch. All the public journals lavished on this chirugical victory the eulogies it deserved. Dr. Stephenson himself made known his cure in a thesis, defended at London in 1821. The year following, 1822, Mr. Alcock was not less successful than the Parisian surgeon. It was then that the rights of M. Græfe to its priority were brought to mind by his countrymen, at the same time that persons from all parts came to Paris to witness the performance of *staphyloraphy*, which soon took rank among the delicate but regular operations of surgery. There is every reason to believe, however, that it had been practised before. In his memoirs on different medical subjects, published in 1764, Robert says in effect: "a child had the palate *cleft* from the veil to the incisors. M. Le Monnier, a very skillful dentist, attempted with success *to unite the two edges of the fissure*, first making *several points of suture* to hold them together, and then *made them raw* with a cutting instrument. Inflammation supervened, which terminated in suppuration, and was followed by union of the two lips of the artificial wound; the child was perfectly cured." A child, a fissure, the suture, the making raw, the approximation, the cure, all, notwithstanding the rather vague expressions of Robert, scarcely permit us to doubt that his dentist had really recourse to staphyloraphy, and not to the suture of a simple perforation of the palatine vault. This operation is then in every respect a discovery entirely French. It is, to proceed, so frequently indicated, that at the end of 1829, M. Rosa had himself performed it forty-five times. M. Jousselin of Liege, had two successful cases, and M. Beaubien a third. M. Caillot, of Strasburg, has published a fourth, and more recently, in 1823, M. J. Cloquet a fifth. M. Morisseau has just published a sixth instance of success, obtained by him at Sable, in the case of a female twenty years old; and M. Bonfils has communicated another of about the same time, to the society of practical medicine of Paris. It appears, moreover, that in France it has been carried from its first step to the highest degree of perfection possible. It is otherwise in Germany, where they are constantly attempting to improve it. Instead of the term *uranoraphy*, proposed by M. Græfe, others have wished to substitute the terms *velosynthesis*, *kyonoraphy*, *uraniskoraphy*, &c. MM. Doniges, Ebel, Hruby, Dieffenbach, Wernecke, Lesenberg, Schwerdt, and Krimer, have all endeavored to simplify the instrumental apparatus; and in England, Mr. Alcock has not adopted in every particular the method of M. Roux; its every stage has been discussed, and deserves to be so.

First Stage.—Cauterization with muriatic and sulphuric acids, caustic, potash, tried by M. Græfe, or even with the tinct. cantharides, lapis infernalis, and hot iron itself, proposed by MM. Ebel, Wernecke, and Doniges, is not more efficient in making raw the fissure of the velum palati than that of the lips. Excision in both cases is indispensable. With *dressing forceps*, a little concave and thin, M. Roux seizes successively the two portions of the palate or division near their free extremity, taking care to include but a very small portion of their edge; he then detaches, proceeding from below upwards and from behind forwards, a strip a line in thickness, which he prolongs as far as their angle of union, and even beyond it if the osseous vault is complete. For this purpose a *straight bistoury*, probe-pointed and very narrow, conducted in the manner of a little saw, appeared to him preferable to the scissors bent upon their handle near their heel, which he at first devised, and which he sometimes uses even now to commence this excision. In the beginning M. Græfe, to fulfill this indication, used in the first place a *long forceps* resembling in other respects dissecting forceps, bent laterally near the point and terminating in a double hook or two small bifurcations; secondly, an *uranotome*, too complicated for me to describe here, which is in its body something analogous to the syringe of Anel, and in its cutting part to the staphylotome of Raw. At present M. Græfe acknowledges the inutility of this instrument, and substitutes scissors in its stead. Doctor Hruby has found that forceps curved like those of Museux, terminating in the form of a crutch, bent at an elbow near their crossing point, one of the bits of which being wider than the other makes it resemble in this respect the pincers described by Dionis, fix very firmly the velum palati during the excision. The forceps of M. Græfe, with or without hooks, seemed sufficient to M. Dieffenbach, who for making the edges raw had a small knife constructed, of which a lancet narrowed near the heel and mounted on a very long handle will give a very good idea. In fine, Mr. Schwerdt does not differ from the preceding authors, except in having his forceps not bifurcated at the extremity.

Second Stage.—The interrupted suture, the only one which can here afford the means of keeping in contact the two cut edges, is nevertheless applied in different ways. The *needles* of M. Roux, short, flat, and of deep curvature, are not narrower than elsewhere at the heel, which has a large square opening. *The ligature* with which he supplies them is a ribband composed of from four to six threads, well waxed and about two feet long. His *porte-aiguille*, already known in the arts, is a kind of forceps with a groove on the internal face of its branches, which a ring tightens or loosens at will as it is pushed forward or drawn back by a stylet, which holds it and which slides along the whole length of the handle of the instrument, of which it forms in some sense an axis. The needles tried by M. Græfe, in 1816, represent pretty much the half of an elliptic curve, cut at the ends of the transverse diameter. They are narrower and longer than those of M. Roux, but their eye is much longer, and perforates them laterally as in the old suture needles. The forceps intended to carry them is not pierced by any wire. Two rings two inches apart, supporting two lateral rods, open or close it by sliding towards the extremity or on the side of its handle. Now the needles of M. Græfe are nearly straight and lance-pointed. He has moreover bent near the beak his former porte-aiguille, so that being fixed by their edge in the hollow presented

by the branches of this instrument, they transform it into a real hook. In fine, still more recently M. Græfe has removed the rings from this porte-aiguille, which at present is nothing more than a jointed forceps, the movable branch of which works on a centre pivot as in the *lithotome cache*. The needles of M. Ebel, perfectly straight, very sharp, and broader in the middle than near the eye, like those of M. Roux, have a square perforation to receive the thread. Those of Mr. Alcock are curved into an oblong arch, and are nearly round; M. Dieffenbach constructed them resembling little larding pins; they have no eye, are straight or very slightly concave, hollowed in their posterior half, and can receive a leaden wire, which their inventor prefers to every other material, and which he easily draws through after them when they are made to pass from the fauces into the mouth and through the velum palati. His porte-aiguille, still more simple than that of M. Græfe, is in reality but a forceps with rings, the branches of which are one-fourth the length of the handles and are bent near their beak almost to a right angle. The needle and porte-aiguille of M. Doniges compose but one instrument; it is a long wire in an ebony handle, bent a little behind, and terminating in front by a hooked needle, pierced near its point and hollowed on its convexity to receive the thread. That of M. Lesenberg differs from it by being formed of two parallel branches, which open and close by the same mechanism as the first porte-aiguille of M. Græfe, so that it is necessary to open it after perforating the parts, in order that the thread it carries may be left free, and itself removed without acting on the ligature. In adopting this needle M. Schwerdt proposed to apply to it the pivot mechanism of the last porte-aiguille of M. Græfe, in order to dispense with the sliding rings of M. Doniges.

Third Stage.—Placing the ligatures does not finish the operation. They must also be tied and fastened. In France it can scarcely be comprehended how for this part of the operation it is necessary, according to M. Græfe, to add to the instruments already mentioned, first, a little hollow cylinder pierced on its sides; secondly, a pair of forceps bent at an angle on the back near the handle, similar in other respects to the second porte-aiguille of this author, and grooved with two hollows on the external face and on each side of its beak; thirdly, a screw, a kind of stopper fitted to the preceding cylinder; fourthly, a second forceps straight and mounted like the common porte-crayon of the lapis infernalis; or, fifthly, a long steel wire mounted upon a handle, swelling and cut square at its free extremity, where are two openings to receive the two halves of the ligature, and form of itself an actual serre-nœud, which however can scarcely act except on metallic wires. Sliding it with one hand towards the palate over the two halves of the thread engaged in its openings, it soon arrives at the suture, which it tightens as much as is desired, and to fix which firmly it is only necessary to twist it by turning it three or four times on its axis. With the other apparatus the ends of the ligature are first passed from within outwards through the lateral holes of the cylinder, which is then seized with bent forceps. It is then pushed on the threads, which the surgeon draws towards him, taking care on the other part to keep them engaged in the external grooves of the beak of the forceps until it touch the palatine vault and the ligature becomes sufficiently tight. Nothing now remains but to close it by carrying there with the other forceps the screw

designed to fill it and arrest the threads, and then leave it in place. This array of unnecessary objects exhibits its own inconveniences without my pointing them out. In proposing the surgeon's knot, and instead of the instruments of M. Græfe, a kind of crutch notched at the ends of its cross-piece to receive the two sides of the thread, which are drawn with one hand while with the other the crutch is made to slide to the suture, M. Doniges does not reflect that the fingers will answer the same purpose infinitely better. I do not perceive, moreover, what real advantage M. Krimer could find in the use of a gold screw over one of iron, like those of M. Græfe, and of black thread over white, and oiled over waxed. The method of M. Roux is incomparably more simple and more natural. After passing one of the two ends of each ligature within the other, he makes a simple knot, which the index fingers, carried together to the bottom of the mouth, permit him to tie as tightly as it is necessary. An assistant immediately takes hold of this knot with the ringed forceps, and holds it firmly that it may not be relaxed, while the operator fixes it by a second knot formed in the same manner, beyond which he then cuts with scissors each of the superfluous parts of the ligature.

B. *Manual.*—Staphyloraphy is not, properly speaking, a difficult or painful operation, but it is long, delicate, and fatiguing, and requires great patience on the part of both patient and operator; so that it cannot be performed but on those who desire it, who feel its importance, and who have firmly resolved to submit to it. It is rare, therefore, that we have to treat children under twelve to fifteen years of age. It requires no precaution in regimen, but the individual should be otherwise in good health. Diseases of the gastro-pulmonary passages particularly endanger its success in consequence of cough, sneezing, and the desire of spitting, which commonly accompany them.

The *Apparatus*, prepared beforehand, consists of, first, three flat ligatures very regular and flexible; second, of six needles, one at each end of the ligatures; third, an ordinary porte-aiguille, or that of M. Dieffenbach, if the nearly straight needles of M. Ebel are preferred; fourth, a good dressing forceps, the breaks of which, a little concave, should not exactly touch each other when closed, except at their point; fifth, a straight bistoury, probe-pointed and narrower than the one in the common surgical case; sixth, scissors for excision and straight scissors to cut the threads; seventh, corks hollowed into a gutter at each extremity, to accommodate itself to the form of the dental ranges; eighth, a spoon to depress the tongue in case of need; ninth, several napkins, a large cloth, cold water and a glass, a basin, and also a little vinegar.

Position.—Covered with the cloth, with a napkin wrapped round him, his head supported by an assistant, the patient is to be placed in a good light, as for excision of the tonsils. A second assistant stands ready to hand the bason and water as well as the instruments, when wanted. Seated in front, on a chair of proper height, the operator first introduces the corks between the molar teeth of each side; then with the forceps in his left hand, he seizes the right border of the division, conducts with his right hand the armed porte-aiguille into the pharynx, brings it forwards, and endeavors to make the point of the needle strike from three to four lines without the fissure and near its inferior part to pass through the velum; he then seizes it with the forceps transversely when it has penetrated as far as possible into the mouth; frees its

heel at the moment the assistant opens the porte-aiguille; without the slightest jerk removes this last instrument; takes the forceps in his right hand, and draws the needle completely forward out of the mouth, the ligature following it. The patient being fatigued, requires to spit and rest a moment. His jaws are therefore freed from what keeps them separate before performing on the left, with the second needle and the second end of thread, changing hands, what has just been done on the right. In order not to confound it with those which are to follow, it is well to tie the free extremities of this first ligature, and depress its noose a little into the throat to prevent its obstructing the application of the others. The two ends are then drawn to the commissures, and held by an assistant on the sides of the head. The surgeon then places the second and the third, if it is thought necessary, with the same precautions and in the same manner, leaving between each two about an equal space. After depressing the noose an inch or so, and pushing it back in order not to expose it to be cut by the bistoury or bent scissors, he takes hold of the left lip of the fissure by the end of the uvula; commences with the scissors the excision of the small lip which he is to take away, and which the forceps is not to quit, while he continues its separation with the bistoury as far as the palatine bone; he executes the same manœuvre on the left lip with the right hand, and returns to the use of the scissors to smooth the edge, if the action of the bistoury has not been equal in every point of the abnormal division. The blood flows, obstructs the pharynx, and often collects in clots about the threads. The patient is to be rid of it, to gargle, and remain quiet for several moments. The most difficult part of the operation is now over. *The ligatures are distinguished*, and put in order so as easily to be found again, and tied one after the other beginning with the lowest. When the gape is considerable and coaptation seems to be difficult, M. Roux separates each of its lips from the posterior edge of the palate bone by a transverse incision from four to six lines deep. The two halves of the velum, being no longer retained by the hard parts, yield and approximate with surprising facility. This mode prevents all dangerous pulling on the part of the threads, and the new wound which is made soon closes spontaneously without giving any ground for apprehension. To obviate the same difficulty M. Dieffenbach follows another method. He finds that a longitudinal incision on each side about four lines from the abnormal fissure is infinitely better than that of M. Roux, all the advantages of which it possesses without any of its disadvantages; that it, too, closes of itself and without injury to relations of the palatine vault, and that it allows a very marked elongation along the whole extent of the flaps which are to be brought together. These two modifications are not unimportant, and should be admitted; the first, when the fissure in the soft parts is complicated with a separation of the bones; the second, which is more natural, when it is intended to overcome resistances solely of these latter, and oppose the retraction of the muscles of the palate. Both prove besides, that in proposing incision of the posterior face of the lips in hare-lip, the ancients were not so wrong as moderns have imagined.

Treatment.—The ligatures once tied the operation is finished, and in no case is any further dressing necessary. It is sufficient that the patient remain without speaking, and take particular care to do nothing which might cause him to cough, vomit, spit, or sneeze; that he take nothing but broth or very

liquid soups until the suture has acquired some degree of firmness. On the fourth day the middle thread may be brought away; the next day the highest may be removed; the third is to be left until the sixth day—understanding that they are to be left one or two days longer if agglutination seems still incomplete at the ordinary period. It is hardly necessary to mention, that to disengage them from the tissues they are to be cut on the side of the knot, which is held and withdrawn with the forceps. If union has taken place only on the side of the uvula, which frequently occurs when the fissure is prolonged on the median line of the jaw, there is no reason to be alarmed. Frequently the opening which results disappears without any extraneous aid in the course of time; but the union may be promoted by making the edges raw; by producing inflammation with lapis infernalis, as I have seen done by M. Roux; with the nitrate of mercury, as M. J. Cloquet tried with success; or indeed with any other caustic. After all, the patient would be freed from it by submitting to wear an obturator or artificial palate, if there were not other resources against the evil.

C. *Modifications.*—Fortunately it is possible, I think, to remedy it in another manner. To close an opening of this kind, M. Krimer made an incision several lines from its edges on each side from behind forwards, comprising the whole thickness of the palatine membrane. Having thus marked out two flaps of soft parts, he dissected them up, inverted them upon themselves, brought them towards the median line, and united them by a sufficient number of stitches, which he was able to remove on the fourth day; agglutination took place perfectly, and the palatine vault was wholly restored. This is a practice assuredly to be imitated; and as the occasion will often present, I am convinced that this idea is a real improvement of staphyloraphy. Among other proposed modifications, I scarcely find any that may be adopted with advantage. If the forceps of M. Græfe, improved by M. Schwerdt, were not in other respects a superfluous instrument, perhaps they might take hold better and more solidly of the parts to be excised than the forceps with rings. As the little knife of M. Dieffenbach might in reality be replaced by a ceratotome, a lancet a little longer than usual, fixed by a band of linen, or even by the common straight bistoury, and which has no other disadvantage than of exposing the posterior wall of the pharynx to be wounded, I see no great objection to using it instead of the probe-pointed bistoury. Plunged from the mouth towards the pharynx through the velum palati very near the fissure; then carried parallel with this fissure, at first forwards or towards the bones; then in the direction of the uvula, it would easily separate a slip, the extremities of which, detached only at the conclusion of the stroke, would evidently render the excision more certain and easy, by furnishing, what is not found by the bistoury, a double support to the instrument to the last. The nearly straight needles of M. Græfe or of M. Ebel, introduced by means of the porte-aiguille of M. Dieffenbach, seem also to present some advantages: first, that of being more easily loosened than with the ordinary porte-aiguille when they have passed through the soft parts; then, of presenting less resistance than curved needles to the forceps which is to draw them through and bring them out of the mouth. As to the wires conveyed by the *lardoires* of M. Dieffenbach—for as far as experience has yet proved that their round form and smallness of size are not too favorable to cutting the tissues—I will not

venture to recommend them. The hook-needles with single or double shafts, of Messrs. Schwerdt, Doniges, and Lesenberg, so ingeniously contrived, at the first glance seem to me, however, worthy of rejection, because it will always be difficult to disengage the thread from them, and withdraw them without deranging any thing after passing them from the pharynx into the mouth through the velum palati. Staphyloraphy, which has been practised in Boston by Dr. Warren, and in New York by Dr. H. H. Stevens, is an operation which every operator should be allowed to modify according to his particular ideas and the parts to be approximated. Staphyloplasm, for instance, might be substituted for it, as was done by M. Bonfils, when instead of a fissure there is a real loss of substance. A flap sufficiently large cut on the palatine vault, dissected and inverted from before backward, could be easily adapted to the form of the opening, and kept in place by the suture. Although incomplete, the success of the surgeon of Nancy gives us a glimpse of what may be expected from this resource. The attempt of M. Krimer besides, is altogether in its favor. If there is an opening in the velum palati instead of a fissure, hot iron, with which M. Delpech obtained a perfect cure on a child; the nitrate of silver, which succeeded with me eventually in a case of perforation in consequence of syphilitic ulcers; or any other caustic, should first be tried.

SECTION IV.

Olfactory Apparatus.

Art. 1.—*Nasal Fossæ.*

§ 1. *Hemorrhage—Plugging.*

Whether the flow of blood from the nose be the result of traumatic lesion or of a vital congestion; when it resists revulsives, cold local applications, styptics, and astringents; or when its duration and its abundance render it alarming, the surgeon ought to have recourse to plugging of the nasal fossæ. This operation, which is both simple and easy, is performed as follows: a roll of lint large enough to fill the posterior opening of the nostril, tied round its middle with a waxed thread, to the circle of which is attached a long single thread, is first prepared; other rolls of less volume, or simply raw charpie, are also prepared beforehand. The operator carries into the pharynx through the bleeding nostril a gum-elastic sound, a piece of catgut, a lead or silver wire, a piece of whalebone, or, if at hand, the sound called Bellocq's; brings through the mouth the extremity of one of these instruments, either by seeking for it with one or two fingers in the back part of the throat or by pushing the spring of the sound if this be used; he attaches the double thread to this extremity, and then withdraws it to place the roll of lint in the posterior part of the mouth, carrying with it the single thread; he detaches the conducting instrument, now no longer necessary; draws again on the lint; engages it firmly in the affected nostril, which is thus closed from behind; he then separates the two ends of the ligature which come through the nose; passes between them from below upwards and from before backwards the free dossils or the raw charpie until the front of the cavity is exactly filled; then crosses them as if

for tying, and tightens them with all the force he thinks necessary upon this last tampon so as to push it backwards, at the same time that it acts upon the other with equal energy to bring it forwards. By this means it is easy to fill the nostril completely with charpie, or, at least, to seal hermetically the two openings, and oppose to the hemorrhage an insurmountable barrier. The ends of thread which come out of the mouth and nose, are to be kept fastened against the cheek or the cap of the patient, until the time of removing the apparatus. This is the only time that the single thread proves to be of use, unless the surgeon has been obliged to remove and replace several times the tampon in the posterior nares before finally removing the whole, which should never take place before the complete cessation of the *molimen hemorrhagicum;* rarely, at the least, before the second or third day. He then cuts or unties the anterior knot, removes the charpie with a forceps, and leaves in the nose but the first dossil, which tractions, exerted on the buccal thread, are to draw down into the pharynx and extract by the mouth.

§ 2. *Polypi.*

Desiccation, cauterization, the seton, excision, extraction, and the ligature, may all cure polypus of the nose; but these several therapeutic methods are far from being equally efficacious, and deserving equal confidence.

1. *Desiccation,* for example, is evidently only applicable to mucous polypi in their early stage; and it is even doubtful if its result be then very satisfactory. Thus it is not used at the present day but as subsequent or auxiliary to excision or extraction. Notwithstanding Aetius, Alexander of Tralles, Actuarius, and a host of ancient authors, the appearance of success obtained by M. Mayer with the powder of *Teucrium marum* does not seem to me calculated to reverse that sentence.

2. *Cauterization* is somewhat more worthy of attention; and I should not be surprised if the future appealed from the unfavorable judgment pronounced against it by the moderns. Hippocrates, who advocated it, performed it sometimes with the heated iron, at others with *caustics.* Arsenic, the acetate and sulphate of copper, according to Galen, were preferred by Philoxenes; while Antipater and Masa employed vermilion of Sinape. Sandarac, pimento, pomegranates, oxyd of lead, the root of the ranunculus, quick lime, and potash, lauded by Archigenes, S. Largus, and P. de Bairo, have since been succeeded by the butter of antimony, which Garengeot used, after protecting the sound parts, by placing a plaster between the polypus and the corresponding wall of the nose, also by the nitrate of mercury, the nitric or sulphuric acids, or the nitrate of silver. These various catheterics were applied to the disease by means of setons, tents, dossils of lint, lead wires, metallic tubes, &c., so as to touch the projecting portion and destroy it by degrees. They were afterwards superseded by injections of lime-water, solutions of alum, of vitriol, astringent or styptic decoctions, in a word, by the whole catalogue of desiccative substances; and the annals of medicine prove, that radical cures of polypus have been effected in this manner. Quite recently, too, in 1827, M. Wagmer has acquainted the academy with remarkable observations, very worthy of exciting attention on this subject if correct. He succeeded in discovering the secret of a German quack, named Jensch, who had acquired

in his province the reputation of overcoming the most obstinate polypi. Being master of this secret, which is nothing more than a mixture of sulphuric acid, butter of antimony, and nitrate of silver, M. Wagmer was desirous of testing its efficacy, following exactly the rules laid down by the empyric. According to him, its effects have been almost miraculous. The following is the process indicated: a piece of metal in the form of a long pin, with a head of the size of a large pea, is the only instrument necessary. Having covered the head with a coat of the caustic, it is applied to the projecting portion of the polypus, and the application repeated from two to five times. Every day the operation is renewed, until the tumor drops off or is destroyed. An injection with a solution of alum is made an hour before, and an hour after each cauterization. After the principal mass has been detached, it is only touched with the lapis infernalis. The injections are to be continued for two months; and to restore the sense of smelling, the powder of *napeta* (Teucrium verum) is prescribed in the form of snuff. I see no reason why this treatment should not be tried, at least on timid subjects, or when the polypus is broader than it is long, and equally difficult to extract or to tie. It would not be the first time, moreover, that ignorance and gross charlatantism has given the idea of a prescription of service in the methodical treatment of diseases.

Actual Cautery, which naturally inspires more confidence than the potential, and which, according to the Arabian physicians, it is sufficient to apply to the forehead to prevent the reproduction of polypi; so highly extolled by Roger of Parma, who applied it to the disease through a canula; by D. Scacchi and P. de Marchetti, who had the courage to repeat its application twenty days in succession; by Purmann, who succeeded three times with an iron wire heated to redness; by Richter and Acrel, who wrapped the conducting tube with a moist linen the better to protect the surrounding tissues, is nevertheless almost wholly abandoned at the present day. It is sometimes recurred to to destroy the remains of polypi left behind, after other methods to arrest hemorrhage which sometimes follows extraction, or for destroying sensible or malignant polypi; but neither even of these cases absolutely require it. In the first, escharotics, which are less alarming to patients, are justly preferred to it. Plugging may easily supply its place in the second. In the third, fire, iron, and medicaments are equally dangerous. This species of polypus which bleeds at the least touch, and often even without being touched, which alter considerably the physiognomy of patients and are accompanied with sudden shootings of pain, yield in fact to no remedy, and constitute the real *noli me tangere.*

For the rest, the operation is easy when the polypus is not too deeply seated. The anterior orifice of the nose is to be dilated for some days, if the cautery is to be carried through that passage. A *speculum nasi* permits us to see the exact situation of the tumor. After these preliminaries, the surgeon takes a canula, soldered at right angles at its base upon a handle, or the ends of a forceps, unless he prefer a simple tube held by dressing forceps, wraps it with moist cloth, and carries it to the polypus, which may be burnt with a rose or olivary cautery heated to whiteness. It would be most frequently impossible to employ this means through the mouth, that is, for polipi of the posterior fauces; and even in the other case, it is frequently followed with intense

cephalalgia, and very serious cerebral affections, as Sabatier has several times observed.

3d. The *Seton* is a resource of another description. Three distinct indications, strictly speaking, may be fulfilled by it. The knotted string, proposed at first by Paul, or rather by Rhazes, then by Avicenna, and most particularly by Brunus, to *saw* the polypi, is a kind of seton quite ingeniously devised, but which, to say the least, will act as much on the Schneiderian membrane as on the morbid tumor. The *silver wire* wound spirally with one of brass, and supported by two handles, one fixed and the other movable, recommended by Levret instead of the seton of the ancients, is no longer used in practice. Le Dran's idea was more natural: passing a hook through the nostrils to take hold of a cotton string carried into the pharynx by the index finger, or, which is as well, passing a piece of catgut which was brought out through the mouth and drawn back through the nasal fossa after a seton had been attached to it. This surgeon succeeded in destroying a polypus of which several roots had escaped him. It was then very easy to pass into the nose every day, first a dossil of dry lint to remove heterogeneous matters, and afterwards dossils spread with digestive or catheteric ointment, designed to favor the removal of the particle of the polypus, and cleanse the sore. With this view and to attain this end, Hippocrates and some of the ancients, have extolled the seton; while intending to simplify Le Dran's process, Goulard has really made it more complicated. The hook, shaped to the turnings of the nasal fossæ, which he prescribes in place of the catgut, the fork which he used instead of the finger for the purpose of carrying the seton behind the velum palati, are evidently less convenient. After all, the process for passing a seton through the nostrils should be in this case the same as plugging those cavities. It is a method, the advantages of which are confined to conducting medicinal substances to some point within the nasal fossæ.

4th. *Excision* may be referred as far back as Celsus, who names a kind of cutting blade *(spatha)* to be used in performing it. Paul cut the polypus with his *spatha polypica*, one extremity of which was furnished with scissors, and tore out the rest with a *polypoxiste*. Abul-Kasem began by drawing down the tumor with a hook, and then cut it with a sharp instrument. Others, Scacchi for example, operated with a simple bistoury, or, like Hutten, with a species of syringotome, or again, like Nessi, with a curved probe-pointed bistoury. J. Fabricius condemns these instruments, and emphatically recommends a kind of forceps in the shape of a double cutting spoon, which M. A. Severin charges him with having borrowed from Nicollini, without acknowledgment, which Glandorp, V. Horne, and Solingen, have successfully modified, and which Dionis, Percy, and B. Bell, have thought not worthy of entire rejection. Le Dran, Manne, and Levret, who under some circumstances also excised polypi, used no other instrument than the ordinary bistoury or curved scissors. But of late M. Wathely has returned to the use of the syringotome; that is, a bistoury lengthened in the shape of the point of a probe, concave on its edge, enclosed in a sheath in which it easily glides towards either the point or the handle.

When the polypus has solidity and is very near the exterior of the pharynx, it cannot be doubted that the process of Abul-Kasem with a bistoury, or, still better, with ordinary scissors or those curved on the side, will often succeed

in removing it. The cutting forceps of J. Fabricius may also perform it under certain circumstances, when in the middle of the nasal fossæ. Nevertheless, excision is an uncertain method, and almost always requires to be assisted by one of the preceding methods, if we would not wish to see the disease sprout up again, and consequently it ought not to be preferred except in some special cases.

5. *Extraction*, which has for a long time been generally substituted for excision, is a method not less ancient and on other accounts very important. From having confounded the cutting forceps with the ordinary forceps, the moderns have incorrectly attributed the first idea of this method to A. Pare, or rather to Fabricius ab Aquapendente. It is found clearly expressed in the books attributed by Sprengel to Thessalus, and to Draco, the son of Hippocrates. Even at that epoch there were two modes of executing it. In one, a piece of sponge firmly tied and fixed by four threads was forced into the nose, then by means of a long needle it was attempted to carry these threads into the posterior fauces, to draw down the polypus by means of a forked instrument, and extract it. The other consisted in first tying the tumor with catgut wrapped with thread, and then extracting it through the pharynx. Paul and Rhazes speak of this last as a common method. Brunus was for removing the *fleshy excrescence* with a crotchet, and G. de Salicet already recommended the forceps. Aranzi, who devised very long pincers, found a great advantage in causing the light which was to fall into the nose to pass through a hole in a window, or a glass globe filled with water. Although this instrument was lauded by Job a Meckren, yet to Dionis are owing the first circumstantial details of its rational employment. Adopted since by almost every practitioner, it has been modified by Sharp, who sometimes used curved forceps; by B. Bell, who had the blades pierced with an opening, and by Richter, who for voluminous polypi invented an instrument with branches to be separately applied, like those of midwifery forceps. Straight pincers are the best when the situation of the disease allows their application. By turning them on their axis, they act on the polypus with a force not to be attained with the curved ones. These are reserved for tumors which may be reached and brought through the mouth. As to those which resemble the obstetrical forceps, they are of real advantage when the mass to be extracted is tóo voluminous for the ordinary forceps to grasp easily midway in the nasal fossa. Whatever in other respects may be the dimensions or general form of the forceps, it is best that their blades be pierced through, or concave within like a spoon, and furnished with little points or notches called *dents de loup*, to render the hold more secure. They should also be as stout as possible, otherwise they are liable to be bent. Extraction after the manner of the ancients has never been entirely laid aside. Thelden, for example, carried a ligature round the pedicle of the polypus, by means of a forceps forming by the union of its blades a ring indented on its convexity and pierced with an eye at each of its free extremities; after which he used this thread for the extraction of the tumor. Though Vogel succeeded with the forceps of Theden, Sir A. Cooper, who, when he can, also extracts polypi with the ligature, thinks proper to reject its use, the actual necessity of which no one will pretend to maintain. Admitting that this mode of extraction, as Sir A. Cooper asserts, has the advantage of being less liable to hemorrhage, and of bringing

away at once the whole root of the polypus and the fibro-mucous membrane which gives it origin, it is yet subject to the serious disadvantage of requiring two operations instead of one, of not being applicable to hard and pedunculous polypi, and of being with difficulty employed in the depth of the nostrils. When the tumor is not larger than a walnut, when it is firm without too thick a pedicle, the following manœuvre may be practised, as it was done by Morand, with success. The two index fingers are introduced into the nose, one in front the other from behind, as far as the polypus, which is moved alternately towards the pharynx and the face until finally detached, when it is brought out through the passage that offers the least resistance. This is a process which, in imitation of M. Dupuytren, it would be well to combine with the use of the forceps. Undoubtedly, by pressing on the tumor with the finger through the pharyngeal opening of the nasal fossa, extraction with the forceps, which draws it in the opposite direction, is more certain and easy.

Operation.—Extraction requires no preparation, unless it has been thought fit to imitate G. de Salicet in enlarging gradually the anterior opening of the nostrils with a sponge, or any other dilatory means. Cold water, vinegar and water, one or more basins, a cloth and napkins, charpie, and all the apparatus directed for plugging the nasal fossæ, a hook, scissors, a probe-pointed bistoury, an ordinary bistoury, Museux's forceps, and several polypus forceps, as they may become necessary, should be arranged on a table or large salver. It would also be well to have ready dossils of lint sprinkled with rosin, and even one or two cauteries, in case of obstinate hemorrhage. The patient is to be covered with a cloth with his face towards a window in a good light, and his head held by an assistant. If an adult, he may have his hands free, in order to be able to gargle at pleasure; but wrapped round and concealed by the cloth, if a child. Standing in front, the operator introduces his forceps into the orifice of the nose; ascertains with this instrument the precise seat of the polypus which he grasps as near its pedicle as possible, taking care also to embrace it very extensively; he then draws it gently towards him; takes hold again a little higher up, if it elongates, with a second forceps without loosing the first, and still with a third, if he is fearful of not removing its root, and then tries to extract it entire at a single jerk. When the tumor is too deeply situated, and not extensible enough to protrude outwards before being torn, it would be better as soon as it is grasped to turn the forceps steadily on itself, continuing to draw until the polypus yields and is detached. During these efforts the instrument is held by its ring in the right hand and near its crossing with the left, in order the better to direct its movements, and in some cases to make it act as a lever of the first kind, by inclining its blades with all necessary force above, inwards, and outwards. If the whole tumor is not at first extirpated, or if several exist, the operation is recommenced immediately and always in the same manner, until there is a certainty that no foreign body is left in the nasal fossa. On this point when we wish to discover if such exist, when the eye discovers nothing more, it is sufficient to make the patient breathe strongly through the diseased nostril, the sound one being kept closed. As long as there is difficulty in the passage of the air, we may be sure that some portion of the polypus has escaped the action of the forceps. But if nothing arrest it; if it arrive freely at the respiratory passage, it is unnecessary to examine further: the operation is finished.

Remarks.—Mucous polypi are too soft, and too easily adapt themselves to the parts which surround them for the narrowness of the opening, to offer any serious obstruction to their extraction. With hard polypi it is otherwise. The irregularities with which they are covered, to adapt them to the form of the meatus; the elongations which they sometimes send out behind, before, or in the maxillary sinus; or, as I once saw with the zygomatic fossa, through the spheno-palatine foramina, of which also M. Blandin gives an example, render it very difficult to draw them out. As in the body of the nostril the bones do not oppose to them a very powerful resistance, they depress them, push the septum to one side, and the spongy bones and the ethmoid to the other, and depress the palatine vault without much difficulty, while posteriorly the pterygoid apophysis, the body of the sphenoid and the thick edge of the vomer, oppose a much more considerable obstacle, and in front the nasal process of the maxillary bone retains them also for a longer or shorter time. They are especially restrained by the ring or fibro-cartilaginous collar of the facial orifice of the nostril. In consequence of its great elasticity, this circle tends continually to return within its natural limits, and resists infinitely better than bone the efforts made against it. If it seem too laborious to extract a large polypus, rather than employ the dilatation of G. de Salicet, we should make an incision from the free edge of the ala of the nose to the triangular cartilage, as advised by M. Dupuytren. When the tumor protrudes from the posterior aperture of the nasal fossæ, it is rarely possible to extract it entire through the nose. In this case the curved forceps become indispensable for seizing it through the pharynx above the velum palati. If in this position it has acquired a large size, or if in consequence of a particular disposition it forces downwards and forwards the posterior half of the palatine vault to the point of contracting the isthmus of the fauces, the method of Manne or of Nessi, which consists in dividing the velum palati with a curved bistoury from above downwards, should not be rejected. Heuermann and Morand have given it their approbation, and I have myself tested it in a similar case; and its condemnation by Schumacher only proves that it was not indispensable in the case he mentions. It is a true unbridling, which is performed without danger of wounding any artery of considerable size. The polypus, which may then be grasped and extracted, if not entire at least piece-meal, with the forceps or the fingers, may also be excised with curved scissors, or the cutting forceps of M. A. Severin. There are cases, moreover, in which these several operations are to be united and skilfully combined; in which, after extracting a great portion of the tumor through the nose, and another through the pharynx, as in a case reported by M. Chaumet, in 1821, whether unbridled or not anteriorly and posteriorly, enough of it remains for the application of the process of Morand. In every case the patient should be permitted from time to time to wash his mouth and nose with cold water, pure or acidulated. If hemorrhage should become too abundant, the operation should cease, and further attempt delayed for several days. When it does not cease spontaneously plugging should be resorted to, which almost always renders the application of caustics or the hot iron unnecessary. These should only be had recourse to after vainly trying inspirations of l'eau de Rabel, a solution of alum, or some other styptic.

Results.—The extraction of polypi is rarely followed by serious accidents. Scarcely any fever supervenes if the patient follows a strict course of diet for

several days. It is a method, however, which is far from succeeding always, or from being employed with advantage under all circumstances. It is particularly proper for mucous and fibrous polypi with a single root, and for all, the base of which is not extended over too large a surface; in a word, for those that may be extracted entire. Sarcomatous polypi, in which the cancerous degeneracy commences at the projecting part, will admit of it, if, as M. Dupuytren maintains, they can be distinguished from others before proceeding to the operation; but, in other cases, says M. Boyer, it will only hasten the march of symptoms, and conduce to formidable changes. Here, more than in any other case, the operator should call to mind the anatomical disposition of the nasal cavities, so as not to grasp and tear out, instead of polypi, the turbinated bones which are on the outer side, nor bruise the septum which is within, nor the cribriform plate of the ethmoid which is above, nor to mistake a simple swelling of the mucous membrane, or any deviation of the bones for an abnormal production, so as to go astray in any stage of the operation; but to carry his forceps in the proper direction, so as to know that tumors may exist in the nose which have their rise in the frontul sinus, as on the patient operated upon by M. Hoffmann; in the maxillary sinus, and even in the interior of the cranium, or in the pterygo-maxillary fossa, for example, as in the subject mentioned by M. Del Greco, who had the superior maxillary nerve transformed into five enormous polypoid masses.

6. *Ligature.*—Like most of the preceding methods, the ligature may be referred to the highest antiquity. Nevertheless, the Greeks and the Arabians hardly proposed it but as accessary to excision or extraction. We must come down to the sixteenth and seventeenth centuries, to find it clearly described and formally indicated. Fallopius performed it with a brass wire, the noose of which he carried round the polypus with a silver canula. F. de Hilden says nothing of his process. Glandorp, who particularly mentions it, practised it with a kind of needle in the form of a hook, having an eye near its point which carried a silk cord. In the course of the last century, it became the subject of numerous researches and modifications.

a. First Process of Levret.—Levret proposed to carry a silver wire by means of a probe around the root of the tumor, and then pass its two ends through a double canula, so as to be able to twist them by turning it on its axis, after fixing them to the rings at its free extremity. Instead of two tubes, soldered side by side in the form of a double sound, Palucci is said to have invented a single canula like that of Fallopius, but divided by a small transverse piece at its nasal extremity. Levret himself used this instrument, and had made it known before it was mentioned by Palucci. It is neither more nor less convenient than the preceding, of which it may be considered a simple variety. The same may be said of the instruments of Nessi, Hunter, and Klug.

b. Second Process.—Unable to reach polypi of the posterior nares with his double canula, Levret had constructed for this purpose a kind of forceps with rings, a porte-ligature forceps with long branches, curved inwards a little and swelling into a bulb at the extremity and hollow, which surgeons have not adopted more than that of Theden, which, without doubt suggested the idea.

c. Process of Brasdor.—The difficult point in the first process of Levret is to engage the polypus within the noose carried by the metallic tube. Brasdor

thought to remedy this inconvenience by drawing through a silver wire doubled to form a noose, as the dossils of lint are drawn forwards from behind in plugging the nasal fossæ. The two extremities being brought through the nose, the surgeon with one hand draws them gently forwards, while, with two fingers of the other carried in the pharynx, he endeavors to direct the noose over the root of the polypus, then introduces them into a *serre-nœud*, and immediately proceeds to the strangulation of the tumor. A simple thread is, besides, fixed to the middle portion of the silver wire, and left free in the mouth in order to draw back the ligature, to replace it if not properly applied at first. This is an improvement, it must be confessed; but as metallic ligatures cannot be tightened but by twisting them upon themselves, and as, consequently, they often break before cutting through the pedicle of the tumor, many prefer a hempen, flaxen, or silken ligature. The sole advantage not to be denied them is that of forming a noose, which is easily kept open without twisting.

d. Process of Desault.—Reasoning from this hypothesis, Desault at first used a ligature of thread instead of the silver wire of Brasdor. Afterwards, to obviate the difficulty of forcing the tumor within so flexible a ligature, he employed another method. His last process is performed by means of three separate instruments; first, a canula slightly curved, terminating in a bulb and furnished with a lateral ring at the other extremity; second, a wire of iron or steel, a kind of *porte-nœud* which slides easily in a second canula, and when open represents a forceps, but when shut its beak forms a ring; third, a *serre-nœud*, another metallic shaft, one extremity of which being bent at a right angle with its axis, has a circular opening, while the other is bifurcated. One half of the thread is fastened to the ring of the canula after passing through it; the other is passed through the ring of the porte-fil-forceps which is then closed by drawing it within the sheath. The surgeon then introduces both instruments together as far as the polypus, and even a little beyond, guided by the floor or septum of the nasal fossæ, that is, the part of those cavities which is the least embarrassed, and endeavors to place them above or below, at the right or the left of the pedicle of the tumor; holds the porte-nœud at this point with the left hand, while with the other he causes the canula to glide over the whole circumference of the tumor, and brings it to a point diametrically opposite, so as exactly to embrace its pedicle; passes the canúla and the porte-nœud once or twice about each other, in order to form a circle of the noose of thread, and withdraws the instruments, leaving the ligature in its place; passes its ends through the ring of the serre-nœud, which he pushes backwards with more or less force for the purpose of strangulating the morbid mass; then fixes the extremity of the thread upon the bifurcation, and attaches it to the cap of the patient to keep the whole within the nasal fossæ. Constriction is increased gradually by drawing each time with greater force upon the serre-nœud, and in a few days the extrication of the polypus is complete. Another process of Desault, less embarrassing than the preceding, consists in carrying the loop of a long thread through the nostril, as far as the pharynx, by means of a gum-elastic sound or a bougie. The operator seizes this loop with his finger as soon as it appears behind the velum palati; brings it through the mouth; detaches from it the conducting sound, which he withdraws through the nose; fixes to it a common thread designed for the same use as in the process of Brasdor; draws it back through the back part of the mouth, supporting

it with two fingers, while an assistant draws its two extremities through the anterior aperture of the nose; after which they are engaged in the serra-nœud, as before. If the fingers are not long enough to follow the noose to the posterior opening of the nares, two threads instead of one, fastened to the ligature an inch apart and then passed each through a canula, will supply their place very advantageously. This process was further modified by Desault himself, for the special purpose of applying it more easily to polypi of the pharynx. Having introduced the extremity of a ligature, and the two ends of a loop of thread of a different color from the mouth and throat, and brought them out by the nasal fossæ, he engaged in his slightly curved canula the extremity remaining in the mouth, penetrated with this canula to the bottom of the pharynx, and employed it for passing the ligature around the polypus; then slipped over it the noose of the accessory thread which an assistant was charged with drawing through the nostril, for the purpose of bringing through this passage the second end of the ligature, which is then passed with the first through the ordinary serre-nœud.

e. Process of M. Boyer.—M. Boyer, who approves of these different methods and has tried the greater part of them with success, has found it best under some circumstances to substitute a catgut for the ligature of thread recommended by Desault.

f. Process of M. Dubois.—With the view of preventing a collapse of the noose of the ligature before reaching the root of the polypus, M. Dubois formerly recommended it to be enclosed in a piece of elastic sound about three inches long, which may be afterwards drawn through the nose by tractions made as if for turning the ligature over a pulley, by acting for a moment on one of its extremities only. This little tube being removed, the other end is drawn so as to bring them even, and both are then passed into the serre-nœud. Unfortunately this piece of sound does not always follow the direction intended to be given to it. It slips sometimes to one side and sometimes to the other, and often is of more hindrance than service, so that means are still to be sought for, to keep open the loop of thread as far as the top of the pharynx.

g. Process of M. Rigaud.—In the month of January, 1829, two new instruments were proposed for this purpose. One named by its inventor, M. Rigaud, a *polyodome,* is composed of three branches of steel, capable of moving, of advancing, and retiring separately or together, in a strong canula. Bent into an arch at their extremities, they form a kind of forceps with three branches, which are opened and closed at pleasure. The extremity of each has a bird's-eye or opening continuous with a small fissure which seems to bifurcate them. The middle of the thread is fixed in these openings, and the ends are carried through the nose by the sound of Bellocq. The forceps, with its three branches closed, is then carried into the back part of the mouth, and are there separated more or less according to the size it is necessary to give the noose. Then the end of the instrument is elevated as much as possible by inclining it towards the nasal fossæ, and sometimes a little to one side, as in using the polypus forceps. To disengage the thread it is sufficient to draw with some force upon the ends which hang out of the nose. The two halves of their terminal fissure being elastic enough to hold the thread when not drawn upon, easily let them escape upon the pedicle of the tumor. What remains has nothing peculiar.

h. Process of M. Felix Hatin.—The other, that of M. Felix Hatin, is a plate of polished metal bent almost to a right angle near its pharyngeal extremity, arched and rounded on its convex surface and chiefly at its vertical portion, and may serve two purposes and answer two indications. Its horizontal portion depresses the tongue very well, while the other obliges the ligature to glide over it until it reach the polypus. It is a very simple instrument which might be supplied in reality by a table-spoon bent forwards near the base of its handle. But the polyodome of M. Rigaud is incontestibly preferable, as it occupies less space, conceals the parts less, and carries the ligature more surely where, and as we wish; and besides it can conduct it with advantage without passing through the mouth upon polypi of the anterior portion of the nasal cavities.

Remarks.—The serre-nœud has attracted the attention of a great number of practitioners. Bichat directed it to be divided so that without being displaced it might be made longer or shorter as occasion required. That of M. Græfe is composed of two pieces, which slide one on the other by means of a lateral button, which permits powerful strangulation of the polypus without deranging the extremity of the threads. But the most ingenious of all is that which Roderick, a wealthy individual of Cologne, had constructed to cure himself of a polypus which had defied all the efforts of the surgeons of Brussels. It consists in passing the two extremities of the thread brought through the nose through a series of small ivory balls, and then fixing them on a tourniquet or little roller. The chaplet which is thus formed adapts itself perfectly to the different curvatures of the nasal fossæ, and causes incomparably less inconvenience by its presence than any other. To increase the constriction of the polypus, it was only necessary to shorten this little chain by turning the roller or tourniquet. The balls may be made of wood, bone, or metal. M. Sauter had them made of the tips of ox-horns. M. Mayor, of Lausanne, ordered them of silver, tin, &c., and employed them upon polypi, as has been said above in the article *Tongue.* In fine, instead of the axle, M. Bouchet, of Lyons, used a little barrel, while M. Levanier employed only a simple catch. M. Braun has also thought proper to modify this instrument, previously hinted at by Girault or Riolan, which the serre-nœud of Desault most frequently renders useless, but which in some cases may become valuable.

The process described by Dionis is reduced to carrying with a crow-bill forceps a sliding knot over the pedicle of the tumor, one of the ends of which is then passed through the nostril with a long needle of lead or brass, and brought through the mouth, while the other remains at the extremity of the nose. It is scarcely ever practicable. That of Glandorp, modified by Gorter, renewed by Heister, who used with success for applying the ligature in a woman seventy years old a bent needle fixed in a handle, with an eye near its point (very similar to the needle invented by Goulard for tying the intercostal artery), cannot be reasonably tried except in cases where the polypus is very near the aperture of the nostril. Admitting for a moment that it may be properly fixed over the tumor, this species of ligature presents still an inconvenience which the ancients seem not to have noticed. As the anterior nasal opening descends below the palatine floor of the nostrils, the cord necessarily presses with force on the facial edge of this floor when it is drawn through the nose, and continually tends to cut or at least to excoriate it. To remedy this

Levret proposed to add a handle to the two ends of the seton, which he sometimes advised to be used. For the same end M. Felix Hatin recently proposed a small plate to be held vertically behind the lobe of the nose, where it is to act as a return pulley and may be made indifferently of metal, ivory, horn, &c., and for which a staff of steel, pierced superiorly with an eye for the passage of the thread, will be a perfect substitute. On the whole, the ligature is not proper for polypi with a large base, nor vesicular polypi. In whatever manner it may be applied, it should be tightened every day until the body it embraces shall fall off. The avowed intention is to produce mortification of the polypus by intercepting the course of the fluids in its pedicle, which it should at last completely divide. Consequently we must expect to see the tumor swell immediately after the operation, and then to become shrivelled or decomposed, and require the use of forceps or hooks when its root is detached. On the other hand, injections of acetated or alum water, or some styptic or antiseptic solution, forms in this case an accessary not to be neglected. Prudence also requires that the patient should keep himself inclined forwards, so that the putrid matters may not descend into the digestive passages. If the polypus is to fall into the pharynx, it will be important previously to pass a thread through it by means of a needle; otherwise it might be directed towards the opening of the larynx after being detached, and cause danger of suffocation. After it comes away it is well to continue the use of detersive, astringent, or styptic injections for a week or two, if the nostril has not entirely ceased to suppurate. Having pointed out, in discussing these several methods, the merit of each in particular, it is unnecessary here to bring them in comparison to determine their relative value. As no single one can obtain an absolute preference, the choice of the process to be used in each individual case must be left to the sagacity of the surgeon.

Art. 2.—Maxillary Sinus.

§ 1. *Perforation.*

The maxillary sinus or antrum highmorianum, is often the seat of diseases for which perforation has frequently been performed. Worms, which Bordenave, Fortassin, Heysham, &c., say have been found there, would without doubt require it, if it were possible to recognize their existence during the life of the patient: so also with the small bodies of adipocire which it has been remarked are sometimes formed in it; but recourse is especially to be had to perforation, to remedy abscess, dropsy, ulcerations, fungus, fibrous and carcinomatous tumors, polypus, necrosis, and caries of this cavity. Jourdain, who about the middle of the last century insisted so much on the advantages of medicinal injections through the natural opening of the sinus, and on the uselessness of its perforation in almost all its affections, has not succeeded, notwithstanding the numerous reasons he advances in convincing practitioners; and at the present day his doctrine has no defenders. On the one hand, it is most frequently found to be very difficult, whatever may be said, to discover with a probe the entrance to the sinus in the centre of the middle meatus of the nasal fossæ; on the other, this opening, more frequently obliterated by disease than in any other manner, would afford no relief even should it be

re-established; and taking every thing into consideration, artificial perforation, being less difficult and more certain, ought to be preferred.

1st. *Method of Meibomius.*—Of the various modes of effecting this perforation, the most ancient is not, as generally believed, that which consists in penetrating into the cavity of the maxillary bone through the sockets of the molar teeth. Molinetti, who wrote in 1675, says, that in a patient who was a prey to horrible pains, a crucial incision was made in the cheek, and the antrum highmorianum, which was the seat of an abscess, was penetrated with the crown of a trephine. It is wrong, morover, to give the honor of it to Meibomius. Zwinger a long time previously, after the extraction of several loose, necrosed teeth, healed a caries of the maxillary bone, by dilating the diseased socket with prepared sponge. Ruysch remarks, that Vanuessen destroyed a polypus only after extracting several molar teeth and cauterizing their sockets with red-hot iron, so as to admit the finger into the maxillary sinus. Some years afterwards, in 1697, W. Cowper, according to Drake, who formally consulted him, preferred the socket of the first molar tooth, and penetrated the sinus with a kind of punch, so as to be able to inject liquids. Meibomius, whose researches were published in 1718, so far from having invented this method, confined himself to the extraction of a single tooth, to give issue to matter accumulated in the sinus, the perforation of which appeared to him to be altogether dangerous. This was also the practice followed by Saint Yves with success upon a patient who had an old fistula, attended with destruction of the floor of the orbit; so that it was necessary for Cheselden to introduce it again, to attract the attention of practitioners. This surgeon preferred the extraction of the third, and even of the fourth tooth to that of the first or second, as laid down by Junker; and in case of an osseous fistula, to enlarge it instead of piercing the bottom of the socket. Since that period, it has been modified by different authors. Heuerman, who also prefers the socket of one of the last teeth, recommends, if the pus does not immediately escape, to perforate the sinus with a stylet, and to place a little canula in the opening, in order to prevent its too speedy obliteration. Bordenave judiciously remarks, that with the exception of the first, all the molar teeth correspond to the maxillary sinus; and consequently, if one be carious or more painful than the rest, that should be removed in preference, but that the third should be extracted if all be equally sound. He prescribes, on the other hand, the extraction of all that are decayed, provided they are no longer of service. A canula of lead, in his opinion, is more proper than sounds and bougies to keep the orifice open for some length of time; and he does not think, after all, that the process should be the same in every case. Desault, who adopted the principles of Bordenave, commenced the operation with a trepan mounted on a swelling handle, and terminated it with another instrument of the same kind but with a blunt end, so as not to wound the opposite wall of the sinus. According to B. Bell, if there is a choice, one of the posterior teeth should be extracted, and in the interval between the dressings the orifice should be kept closed with a plug of wood. Richter perforates the socket with a trocar. He forbids the canula which is placed in it to be left open, because particles of food might be introduced through it into the sinus. Deschamps prescribes a permanent canula to be fastened to one of the teeth by a thread. The method of Meibomius, which offers the advantage

of placing the opening in the most depending point of the sinus and of leaving no external cicatrix, the execution of which is besides simple and easy, and preferable to all others when there is a carious tooth, should yet be rejected in the contrary case, and also when the alveoli, having long been deprived of their processes, are entirely closed.

2. *Method of Lamorier.*—In this case, Lamorier, a surgeon of Montpellier, recommends the penetration of the maxillary sinus immediately below the zygomatic process, between the malar bone and the third molar tooth. This point corresponds with the summit of the cavity, and its parietes there present the least thickness, and it is there more easily reached. An assistant with a blunt hook draws the labial angle outwards and upwards. The operator incises the fibro-mucous membrane which covers the bone at the bottom of the maxillo-labial sulcus, and on the designated point, with a scalpel or good bistoury, traverses the osseous wall with a strong punch, enlarges the opening as much as he judges necessary, and concludes by inserting into it a tent of charpie.

3. *Method of Molinetti.*—Others, returning to the operation of Molinetti, have advised the division of the cheek first between the malar bone and the infra-orbitary foramen, and then penetrating from this wound into the interior of the sinus; but unless imperatively demanded by the circumstances, the division of the external soft parts ought to be avoided.

4. *Method of Desault.*—Here Desault prescribes entrance into the maxillary sinus through the canine fossa, piercing beneath the superior lip. Instead of the perforators, one sharp and triangular and the other blunt, invented by Desault for this species of operation, Runge, who practised in 1740, employed simply a scalpel, which he turned four or five times on its axis to enlarge its first opening. The trephine, which Charles Bell designed for the same purpose, has neither greater nor less disadvantages than the scalpel of Runge, or the perforating trepan of Desault.

5. *Method of Gooch.*—Upon a patient who had no molar teeth, Gooch conceived the idea of perforating the antrum highmorianum through its nasal surface, and fixing there a leaden canula. Ol. Acrel had already followed a process nearly similar; that is, after operating in the manner of Cowper, he placed a second canula in the sinus through the nose, which presented there a fistulous opening.

6. *Method of Ruffel.*—A buccal fistula of the maxillary sinus suggested to Ruffel the idea of inserting there a trocar, and bringing it out above the gum to establish a counter-opening. A seton was then passed and kept in this passage for six weeks, when success crowned the efforts of the surgeon.

7. *Method of Callisen.*—Callisen, who adopted the seton of Ruffel, and was followed in this particular by Zang, thinks, with reason, if fluctuation is perceived at the palate vault, that the artificial opening ought to be there established. Busch and Henkel have fully succeeded by means of a seton introduced through a fistula of the floor of the orbit, and brought into the mouth through an opening in the alveoli. Bertrandi did the same, except that he omitted the use of the seton with a patient who could not open his mouth, and who had also a fistula at the orbitary wall of the sinus.

8. *Method of Weinhold.*—In the process which the Germans attribute to Weinhold, the surgeon first carries his instrument to the superior and

external part of the canine fossa, and directs it obliquely downwards and outwards, avoiding carefully the branches of the infra-orbital nerve; perforates the sinus, and then fixes a dossil of lint in the wound. If the sinus has no other issue, Weinhold directs it to be perforated through and through, either by pushing his first instrument into the mouth through the palate vault, or by a curved needle when he means to place the counter-opening without the gum and above the alveoli. An eye, which is found in both instruments, permits a thread to be drawn at the same time through the sinus, conducting a roll of lint designed to perform the office of a seton, which is covered with some appropriate medicament. This method approaches nearly that of Ruffel or of Henkel, and may be tried as well as that of Desault or Lamorier. It resembles also that of Nessi, who, after having largely opened the sinus through the mouth, inserts a trocar and destroys as much as possible of the anterior wall below the malar bone or the canine fossa.

Remarks.—On the whole, perforation into the maxillary sinus is performed in the point of election or of necessity. The first may vary according to the ideas of the operator. The circumstances, on the contrary, determine the second. In case of abscess, dropsy, fistulæ, and ulcerations, the operation is almost always performed in the place of election. Then, provided one of the molar teeth be unsound, it must be extracted, together with the adjoining tooth; the gum is then to be cut down to the bone, externally, internally, behind, and before, forming a kind of square flap, and to be completely detached from the surrounding tissues; after this, the alveoli are to be perforated with the instruments of Desault, and an opening made large enough to admit the finger into the sinus. M. Boyer, who follows this process, insists with reason on the necessity of giving this opening considerable dimensions. If all the teeth are perfectly sound, or if the patient has lost them a long time before, and the alveolar margin is round and full, preserving its natural firmness, the method of Desault or Lamorier, in my opinion, deserves the preference. Supposing that it does not succeed, there will always be time to have recourse to that of Meibomius, which, it cannot be denied, is incomparably more painful and terrifying to the patient.

§ 2. *Foreign Bodies; Polypi.*

Simple extraction of a foreign body, a ball, shot, or splinters of bone, for example, must be effected through the anterior wall of the sinus. When a polypus, a fungus, or a necrosis, on the contrary, is to be removed, reason requires that we should attack it at the point to which it seems naturally to tend, or which has sustained the greatest alteration. Thus it sufficed Dubertrand, in extirpating a polypus of this description, to unite the two alveoli by breaking down the division between them, and removing the fragments of carious bone; while Caumont was obliged, in a patient who had fruitlessly submitted to a similar operation, to reach the tumor through the canine fossa where it showed itself; and again, it was necessary in the case cited by Chastenet, to destroy nearly half of the maxillary bone with its palatine process to accomplish the same purpose. When the antrum highmorianum is opened for the sole intention of giving free issue to the matters it secretes or exhales, the sequel of the operation is reduced to simply detersive, astrin-

gent, antiseptic, or dessiccative injections, until the bottom of the wound is covered with cellular granulations of a good red color. If, at the same time any necrosed osseous portions exist, they are to be removed. In this case it is often necessary to prolong the incisions, enlarge the opening, and have recourse to the saw, scissors, cutting nippers, or the gouge and mallet. The same occurs in case of exostosis, and every other alteration of the osseous tissue. When the sinus contains a polypus, the tumor is treated as if it were in the nose; with this difference, that extraction, which is generally applicable, rarely fails of being sufficient, and it cannot be seen at least what advantage is here presented by the ligature. After its periphery has been isolated, and its pedicle or base displayed, it is grasped with polypus forceps, or, if found more convenient, with the forceps of Museux, which has been frequently used by Dupuytren. It is then extracted by pulling, or rather by twisting it upon itself. If it has not sufficient density to resist the grasp of the forceps, it is removed by incision after making it yield as much as possible; and if any osseous bands or lamellæ prevent its extraction, they are to be divided without hesitation, at least whenever there is no danger in touching them. When it has more breadth than prominence, or when instead of polypus we meet with fungi or any other degeneration, we are sometimes obliged to remove piece by piece with the common or probe-pointed bistoury, or a scalpel with a truncated point, short, wide, a little bent on the side like the knife of F. de Hilden, devised by Pelletan, and approved by M. Boyer; or, in fine, with any other appropriate instrument; a kind of cutting spoon, like that of Bartisch, for instance, which is sometimes employed by M. Dupuytren. On the other hand, if the tumor be too voluminous for easy extraction through the maxillo-labial fissure, we must incise boldly the whole depth of the lip or one of its commissures, in the most suitable direction. The twisted suture renders union of this wound so easy, that it would be truly culpable to neglect it whenever the operation would be simplified by its use. Caustics may be applied to destroy what could not be removed by extraction and excision. Mineral acids, butter of antimony, and better than all, the acid nitrate of mercury applied by means of forceps, and retained by dossils of lint, have the advantage of not transmitting far their action, as does the actual cautery, which in this point in particular is to be dreaded on account of the vicinity of the eye. However, it is to be remembered, that Garengeot only succeeded in destroying a fungous mass of the antrum maxillare, by consuming it with red-hot iron, after it had resisted repeated excision, extraction, and chemical escharotics. The nitrate of silver, alum, sulphate of iron or copper, and every substance rather styptic than really caustic, are not adapted in truth but to vegetations, small ulcers, and swellings; in a word, to alterations unconnected with the bones and exhibiting none of the character of malignity. It need not be said that if a misplaced tooth be the cause of the disorder, it should be sought for and immediately extracted. The records of the art contain facts extremely curious on this point; for example, the one published by M. Dubois. Expecting to find a fungous tumor, this practitioner saw only a turbid liquid matter flow from the maxillary sinus, into which he had just made a large opening above the dental range. The wound soon closed, but the tumor remained. With the assent of Messrs. Pelletan and Boyer, &c., M. Dubois extracted three teeth, removed a large portion of the

alveolar margin, and thus entirely brought to view the antrum; he found no fungus, but perceived at the top of the cavity in the substance of its anterior wall a whitish projection, which was nothing but a tooth, an incisor, whose root was found rivetted as it were in the sinus. As to hemorrhage, these several manœuvres sometimes render it so abundant, as to require the operation to be temporarily suspended. If it does not stop spontaneously, eau-de-Rabel, vinegar and water, or plugging with balls of charpie springled with rosin, and even on emergency heated iron, are at the disposal of the surgeon, and always afford an efficacious remedy.

Art. 3.—*Frontal Sinus; Perforation.*

The direct communication of the frontal sinus with the middle meatus of the nasal fossæ, renders the perforation of them rarely indispensable. The polypi which are sometimes developed there, soon extend into the nose, where they may be reached with the forceps as well as if they sprung from any other point of the nostril. Heister is said to have extracted them by this passage. Pus, glary mucus, sebaceous and fibrinous concretions, and worms, have all been found in them, but less frequently than in the maxillary sinus; yet it is rare that these substances accumulate there in any quantity, and do not find issue through the nose. The perforation of the frontal sinus is therefore really indicated but under very few circumstances. Without being difficult or delicate, its execution nevertheless requires some important precautions which are not to be neglected. Thus, in order to strike as low as possible upon the frontal cavity, it will be proper, in my opinion, to lay bare the bone between the supra-orbitary foramen and the root of the nose. Then the small crown of the trepan, or Desault's instrument for the maxillary sinus, is to be directed obliquely backwards, upwards, and inwards. Through this opening, more or less enlarged with forceps, a hook, crotchet, or scissors, we are to seek for the tumor or the foreign bodies to be extracted; apply a tent simple or medicated to the disease; make injections and introduce caustics, or even the hot iron if necessary. The air which penetrates freely from the opening of the frontal sinus through the nose, and *vice versa*, seems at first view to become an insurmountable obstacle to artificial cicatrization, and to convert it almost necessarily into a fistula. This has been observed more than once; and M. Dupuytren and some other practitioners look upon it as the constant result. But we have at present sufficient proof of the contrary, so that we need not hesitate on account of this opinion. Wounds of the frontal sinus close quite as well as those of the antrum highmorianum, and their chief inconvenience consists in leaving indelible cicatrices on one of the most striking parts of the countenance

Section v.

The Face.

Art. 1.—*Osseous Cysts.*

Tumors filled with turbid serosity, as in ranula; or of a fibrous, fatty, or fungous nature; or even composed of several of these elements at once, have often been observed without the maxillary sinus, and in the very substance of

the bones of the face. Runge, who appears to be one of the first to notice them, says that his father and himself had met with them in either jaw, and that their point of departure is often from the summit of a dental root. It is probable also, that those pretended lymphatic congestions, the parietes of which were *as thin as parchment*, which Kirkland locates in the antrum highmorianum, belonged to the same kind of affection. Did not Callisen fall into the same error when speaking of tumors with separate compartments, which according to him required the extraction of several teeth? Siebold, who saw an osteo-sarcoma between the laminæ of the sinus, made section of it without causing pain, and cured his patient; and has distinguished better than his predecessors the special position of the disease. Runge, who besides describes it very well, did not let the fact escape that upon pressure with the finger it recedes returning immediately afterwards to its place *with noise*, ranks it among the affections of the sinus. Sprengel accuses him of using several times in his dissertation, inadvertently, no doubt, *the inferior jaw* for *the superior jaw*. In this the learned historiographer is evidently mistaken. It is certainly the inferior jaw that Runge means when he speaks of it. Only he uses improperly the term *sinus*, in designating tumors which have their seat without the cavities. These isolated facts had fixed no attention, and to M. Dupuytren is the honor due of giving in his clinical lectures detailed notions of the disorder here treated of. I have met with four cases. The two patients from the vicinity of Tours, given by M. Fabre in *La Clinique* had been submitted to my examination before being operated upon by M. Dupuytren. Although without the sinuses, and observed more frequently on the inferior than the superior jaw, and on the ramus as well as the body of the bone, the tumor nevertheless nearly always bears some relation to a diseased state of the teeth. Similar in form and external appearance to carcinomatous or fungous tumors, it differs from them essentially, in being more easily overcome by art. Analogy leads to the opinion, that the various treatments approved of in lesions of the maxillary sinus, would be usually applicable to these; and that by opening them on the internal face of the lips or cheeks, when they are situated so as to admit of this operation, many of them would disappear, so that it would be no great disadvantage to confound them with polypus or other tumors developed in the antrum highmorianum, as happened to the father of Runge, and, quite recently, to M. Dupuytren himself. But until the present, at least, M. Dupuytren has found it sufficient to cut extensively through the cheek, then make injections, and place every day a tent of charpie in the wound, to produce its diminution and revolution.

Art. 2.—Section of the Facial Nerves.

Neuralgia of the face, a cruel disorder, and characterized by the severest pains, has often been subdued by division, cauterization, and excision of the affected nervous trunk. It was natural to suppose, that by destroying the continuity of the sensitive cords, transmission of pain to the cerebrum would be prevented, and the disease be thus completely removed. But as the nerves are possessed of no power of retraction, it was to be feared on the other hand, that after being divided they might immediately reunite, and therefore that simple division would not be followed by a lasting relief. Experience has

unfortunately but too well confirmed these apprehensions. Hence the idea of destroying enough of the nerves to render impossible the re-establishment of their continuity, presented itself. Caustics or fire, proposed to fulfill this indication, have the serious disadvantage of producing large cicatrices, and horribly disfiguring the patient. In our times the cutting instrument has been generally substituted in their place. By means of an incision in a line with the corrugations of the skin, of the muscular fibres, or the principal vessels, they may be exposed at their exit from the bones and cut, before sending off any branches, and a portion two or three lines long removed. The wound, uniting by the first intention, is unperceived after healing among the lines of the face, and the continuity of the nerve being forever destroyed, it seems impossible that neuralgia should not be arrested by such powerful means. Nothing is wanting on this point, but that clinical observation should never have contradicted the theory. Often, too often, the disorder resists the best performed excision as well as mere incision, and many patients have not been more relieved by one of these operations than by the other, nor by the deepest cauterization. At the hospital St. Antoine, in 1829, there was a man of about forty-five years of age, who for fifteen years was afflicted with a tic douloureux, and who submitted successively to section and excision of all the nerves of the face, without any kind of benefit. However, as more fortunate results have been published, when all other modes of treatment have been vainly tried, especially when the suffering is extremely severe, it is a last resource to propose to the patient, and of which perhaps it would be inhuman to deprive him. The cords which may be subjected to it are four in number; the frontal, the infra-orbital, the inferior dental and the facial.

Frontal.—To derive all possible advantage from excision of the supra-orbital nerve, it should be taken at the point, where, issuing from the supra-orbitary foramen, it is reflected and passes over the bone before the origin of the anastomosing branches which part from it to be united with the neighboring nerves. Here it is only covered by the skin, a thin layer of cellular tissue, and some pale fibres of the orbicularis muscle. The artery that accompanies it is not of sufficient size to cause fear if wounded, and in the vicinity no other organ is seen which can be exposed to the touch of the instrument. If not distinguished at first sight through the integuments, it is only necessary, for determining its location, to recollect that the fissure or canal which gives it passage, is found at the union of the internal third with the external two-thirds of the superior orbitary arch, or about an inch from the root of the nose; and by running the finger along the edge of the orbit from the nasal apophysis to the temporal apophysis of the frontal bone, it is almost always possible to determine its exact position.

The operator, placed behind the head of the patient, lifts the eyebrow with his left hand, while the lids are depressed by an assistant; assures himself anew of the place occupied by the diseased nerve; takes a bistoury in his right hand, holding it as a pen; applies its point upon the internal orbitary apophysis; brings it upwards, then outwards, and divides all the tissues down to the bone to the extent of an inch, a little above and in the direction of the adherent edge of the eye-lid; separates gently the edges of this crescentic wound; finishes the section of the nerve, if not already complete; takes hold of its anterior end with a good dissecting forceps; insulates it; and excises a

sufficient portion to prevent the subsequent re-establishment of continuity of its two extremities. The immediate union of the integuments may be permitted to take place. The loss of substance in the nerve gives, as far as that organ is concerned, all security on this point. Yet, as the least infiltration of heterogeneous fluid in the midst of lamellæ so flexible, and tissues so easy of separation as those of the eye-lids, the orbit, and the forehead, might induce purulent collections and dangerous inflammation, it seems to me prudent, as a general rule, to permit the wound to suppurate. It is therefore dressed lightly with a pledget of lint spread with cerate; or, if there be hemorrhage (but only for the first time), with a little soft linen and rolls of charpie. No other care is demanded than in simple wounds, and cicatrization soon takes place.

2d. *Infra-orbital Nerve.*—More deeply situated, surrounded by parts more important, and spreading at its exit from the bone, the infra-orbital nerve, is much less easy of excision than the preceding; but on the other hand, it is much less subject to neuralgia. Two courses may be followed to reach it. The first is through the mouth. Prolonging an inch upwards the furrow in which the lip meets the jaw, we traverse the whole depth of the canine fossa, and arrive at the root of the nerve, which is found in the direction of the first molar tooth, three or four lines below the orbit. The bistoury, which were necessary in the first, is to give place to straight scissors in the last stage of the operation. Followed by M. Richerand, who even impinges on the bone with his instrument, this method, the principal advantage of which is to leave no traces on the countenance, only admits of simple division of the cord, which should be excised. In the other, the instrument traverses from the skin to the bone all the soft parts that compose the cheek, and hence it is much more dreadful, at least to the fair sex. Fortunately, by following the natural lines of the face instead of being governed exclusively by the direction of the fleshy fibres, it is possible to obtain a cicatrix scarcely perceptible.

Process.—The patient should be seated, dressed, and held as in all other operations on the face. Armed with a straight bistoury, and placed in front, the surgeon makes an incision at the bottom of the naso-jugal line, that is, of the depression or line extending obliquely from the ala of the nose towards the middle of the space which separates the prominence of the cheek from the corresponding labial angle; in this direction then he makes an incision from an inch to an inch and a half long, beginning at the external face of the perpendicular apophysis of the maxillary bone, dividing at first but the skin; he then soon meets with the facial vein, which he pushes outwards, some fat, and the proper elevator of the lips, which he pushes inwards, and the canine muscle, which often conceals the nerve by its internal border; he then uses a steel director to put aside all these objects, tears the filaments and layers which still conceal or may conceal the affected nerve, cuts the nerve close to the infra-orbitary foramen, removes a portion of it, and the operation is done.

3d. *Inferior Dental Nerve.*—The inferior maxillary nerve issues from the jaw through the mental foramen below the osseous furrow, which separates the alveoli of the canine and first molar tooth. This point is very easily reached. While with one hand he inverts the lip outwards and downwards, the surgeon with the other cuts through, layer by layer, from above downwards, with a straight bistoury, the tissues at the bottom of the maxillo-labial sulcus. The above mentioned teeth are his guides. At the depth of several lines he meets

with the nerve; insulates it to the extent of a quarter of an inch, by separating from the jaw the posterior face of the soft parts which cover it, and excises it, following the course laid down for the frontal, and using no dressing.

An American surgeon, Dr. Warren, has been bold enough to seek for the trunk of the maxillary nerve, and perform its excision in front of the pterygoid muscles. A crucial incision of the skin, of the parotid gland, and masseter muscle, allowed him to apply the crown of a trepan upon the coronoid process, and seize the nerve with a stylet above the dental canal, and remove about three lines of it with the scissors. The artery was wounded, and tied without difficulty. The patient, whom other excisions had temporarily relieved but not cured, and who still experienced horrible pain, ceased to suffer after the operation, and has continued well ever since. *Le vrai peut n'etre pas vraisemblable.*

4th. *The Facial.*—Spread over almost every point of the face, the portio dura of the seventh pair would at first seem to be more subject to facial neuralgia, and therefore has been frequently excised. Its temporo-genal branch, the only one which has been ventured upon, crosses the neck of the condyle of the jaw at the place where the lobe of the ear is continuous with the integuments of the face. At this point it is proper to expose it. An incision is made a little oblique from before backwards or nearly vertically, which, beginning from the zygomatic process, terminates on the posterior edge of the jaw above its angle. We must divide successively the cellulo-adipose layer, an aponeurotic expansion, and several small prolongations of the parotid gland, before finding the nerve, which is separated from the bone only by lamellated and filamentous cellular tissue. In this way the temporal artery is avoided with certainty; and if the transversalis faciei be wounded, it will be very easy to compress it if the hemorrhage should prove troublesome. The other, the cervico-facial branch, lost as it were in the parotid, presents too much anomaly of position, and the trunk itself of the facial runs too deep and is surrounded by too important parts, to let us think of its excision. An appeal ought to be taken from this judgment, without rashness. I have assured myself frequently on the dead subject, that the nerve now spoken of may be exposed without danger at its exit from the cranium, before it has given off any other branches than the mastoid, digastric, and stylo-hyoid filaments. For this purpose the operator has but to make a vertical incision an inch and a half in length between the mastoid process and the lobe of the ear, and keeping close to the anterior face of the bony process and the corresponding margin of the sterno-mastoid muscle, to divide to the depth of from six to ten lines, the integuments, the cellular expansion, and the parotid, which is to be drawn forwards. The lips of the wound being separated, the nerve is to be seen at the bottom, near the middle of the space which separates the temporo-maxillary articulation from the summit of the mastoid process, where it appears to direct itself towards the edge of the inferior maxillary. The division and even the excision of this nerve, is then as simple and as easy as that of the frontal; and it is at once evident, that this alone can offer all desirable guaranty in this case, provided these several excisions of the nerves be the remedy for facial neuralgia. I raise purposely here some doubts of their value, because facts have not yet pronounced conclusively in their favor. If in some cases they have been followed by a marked diminution, or even a complete cessation of pain, they have

been seen much more frequently to produce no relief or but a momentary ease. I have already mentioned a man who had submitted to them all on both sides of the face, without any appreciable advantage; and M. Boyer has imparted to me a similar observation. The patient upon whom he excised, one after the other, the four principal nerves of the face was at first slightly relieved, but was not more completely cured than he whom I have mentioned. Moreover, if the opinions of Ch. Bell are correct; if it is true that the frontal infra-orbital mental; in a word, all the branches of the fifth pair are exclusively *sensitive*, while the seventh pair presides over only the muscular actions of the face, it is evident that the division of the latter will only produce paralysis of the muscles of the face, and it is only to that of the three others that we are to look for what concerns neuralgia.

SECTION VI.

Auditory Apparatus.

Art. 1.—*External Ear.*

§ 1. *Otoraphy.*

Pibrac, and those who, like him, in the last century declaimed against the abuse of sutures, were wrong in proscribing that of the ear. If it be true that in wounds of the pavilion of this organ, adhesive strips, position, and a bandage sometimes suffice to produce a good cicatrization, it is also true that these means often fail, and are altogether inferior to the suture. When it is performed, in whatever manner, I see no reason for including only the skin and placing as many stitches behind as before, in order to avoid the cartilage, according to directions given by the ancients. Leschevin, and quite recently M. H. Larrey, have shown that there is no inconvenience in including the whole thickness of the ear in the loop of the stitch. Every wound by a cutting instrument which completely divides the external ear, should be immediately closed by the suture. Old divisions are to be treated in the same way after making a fresh wound of their edges, conforming in other respects to the principles laid down under the article *Hare-lip*. However slender may be the pedicle of the flap, the division of it should never be completed before attempting to restore it to its place and procure its coaptation by the suture. If it mortify we are but where we were, and may remove it and leave the wound to heal by the second intention. The facts observed at Heidelberg, by M. Hoffaker, show, moreover, that we should not lose all hope of seeing on the ear as on the nose, the adoption of a flap which had been completely separated from the living tissues by the wound.

§ 2. *Otoplasm.*

The art of patching the ear is as ancient as that of replacing the nose. Galen, Paulus Egineta, and Celsus, mention both. There is every reason to believe that the Brancas, and several other surgeons of Italy, caused it to make new progress in the course of the fifteenth and sixteenth century. In the case he relates, Tagliacozzi says, that after the cure the resemblance between

the two ears was so exact, that they might easily be mistaken for each other. Since then, however, there has not been much notice taken of otoplasm; so that M. Dieffenbach, of Berlin, who performed it with success, may in some measure be considered as its inventor. Doubtless if the whole external ear was removed, we could not think of reconstructing it, but would decide on replacing it by a metallic one; but when it is only partially destroyed, and at least one half yet remains, we may attempt to restore it to its natural dimensions. The lobe especially is very easily reproduced. When the loss of substance does not extend beyond the ante-helix, or even when it comprises nearly the whole of the helix, we should not despair of success. Without even acquiring the firmness of the destroyed cartilage, the new tissues which are put in its place become sufficiently firm to render the deformity much less shocking. As in the case of the nose, the skin of the neighboring parts is to supply materials for the repairs. We begin by excising, smoothing, making raw, the affected edge of the ear. We then incise above, below, or at the posterior part of the concha, the integuments covering the temple, the mastoid process, or the subauricular depression of the neck, a little nearer the meatus auditorius than the level of the raw border, and in a direction parallel to this border. Another incision, of more or less length, carried from each extremity of the first, gives a flap of the form and extent desired, which is to be at least one half larger than the loss of substance seems to indicate. In dissecting this flap from the first wound towards its adherent edge, it is necessary to raise with it a considerable thickness of cellular tissue, which lines its posterior face and affords it nutrition and life. The surgeon then fits its free edge to the bleeding wound of the external ear, and effects its union by means of fine short needles, and a sufficient number of points of the twisted suture delicately adjusted. To conclude, he has but to pass behind the kind of bridge which results from this arrangement a bandage of linen spread with cerate, for the purpose of preventing readhesion of the dissected skin. After enveloping the whole with compresses steeped in a tepid infusion of mallows, the patient is put to bed. At the end of three, four, or five days, if union is well advanced, the needles may be removed; at least those near the most solid points. In a contrary case, it is to be seen if it would not be useful to replace some of the first needles with others. When the cicatrix is firm, that is, from the fifteenth to the thirtieth day, the tegumentary flap is to be separated from the cranium, which, becoming free, requires new attention. First, its inequalities are to be removed by rounding its angles; in a word, its external edge is to be shaped. For fear of its mortifying, it is to be dressed for some days with emollient dressing, when it is treated, together with the wound left on the head, as any other solution of continuity. In retracting it becomes thicker, hardens, takes the form of a cushion, reddens after being at first pale, and remains a long time more highly colored than the neighboring parts of the external ear. Such at least was the state of things in the case related by M. Dieffenbach.

§ 3. *Perforation and Dilatation of the Auditory Canal.*

When imperforation of the canal of the ear is complete, and when it has its source in the temporal bone itself, as of which I have observed a double example on the body of a child four years old; and a second, on one side only,

in another child ten or twelve years old, it is incurable and requires no kind of treatment. On the contrary, to whatever degree the contraction may be carried, if there is barely room to admit the passage of a needle, as seen by Lametrie, or if the coarctation is trifling and the obstruction occupies but a point in length, or has invaded the whole extent of the canal, an attempt should be made to remedy it by dilatation. Caustics were preferred by some ancient authors, and Hippocrates himself might here become dangerous, and would very rarely attain the end proposed. Canulæ, sounds, or tents increasing gradually in size, should be continued for a long time after the cure, and even sometimes during life, for the wall of the canal preserves almost always a great tendency to recover its former dimensions. In certain cases the walls of the auditory passage are directly applied to each other, and cannot be efficaciously separated but by a metal canula of a diameter equal to that of the auditory canal in its normal state. If deafness depend evidently upon an anomaly in the curvature of the cartilaginous prolongation of the ear, it may be remedied by a permanent gold canula placed in this canal, of which M. Boyer gives an example taken from his own practice. More frequently the external ear is closed by a membrane or kind of diaphragm. If it be not too far from the pavilion, it should be incised crucially with a bistoury wrapped with linen to within two lines of its point. Its flaps are then cut away with the same instrument, or small scissors, each being held by a hook. Others have advised perforation with a trocar, and absorption to be determined by a dilating body; but this method is not so good as the first. The incision which Paulus Egineta adopts when the accidental diaphragm is deeply seated, as in the preceding case, is rejected by Fabricius ab Aquapendente, under the pretext that it exposes the internal ear to be penetrated, is practised at the present by the greatest practitioners in all cases, except where it seems likely to touch the membrane of the tympanum. In this case they follow the precepts of J. Fabricius, having recourse to caustics, the best of which without doubt is the lapis infernalis. Leschevin directs it to be fixed in the barrel of a quill, and carried to the bottom of the canal through a silver canula. Three or four cauterizations, with two or three days' interval between each, generally suffice, and the operation, which gives hardly any pain, is not in the least degree dangerous. In the same manner every other atresia, complete or incomplete, is to be attacked, when it depends upon a fault of conformation of the soft parts, and is not purely membranous. When the instrument has passed beyond the obstacle, which is indicated by the sudden want of resistance, the trocar only is withdrawn so that its canula may be used to conduct a bougie to the bottom of the auditory canal, which is renewed every day with gradually increasing size.

§ 4. *Foreign Bodies.*

A thousand different kinds of foreign bodies may be engaged in the auditory canal, and a thousand different means have been proposed for their extraction. In obliging the patient to hop on one foot, and making him use sternutatories, Archigenes had the same intention as Celsus, who recommended the head to be rested on a table and violently jarred by raising the patient by the feet, or by striking the sound ear, or letting fall suddenly after lifting it the body on

which it rests. Alexander, of Tralles, has given the idea of drawing them out with a tube; and Mesue, who reproduced it, has, like J. Arculanus, constructed for this purpose another instrument designed solely to pump out liquids. The sucking pump, an instrument recently invented by M. Deleau, which may be used for drawing out air, serosity, pus, &c., as well as for injections into the ear, is made upon the same principle. Leschevin, who contends that air entering the canal of the pavilion is the ordinary cause of the buzzing and tingling in the ears, had been anticipated by Reusner, who to remedy this inconvenience proposed a small silver canula to be left permanently in the auditory canal. The hardened cerumen dissolves very well in the oil of sweet almonds, as remarked by Avicenna, but still better in warm soap-suds, or even pure water, if we trust to the experiments of Haygarth, who rejects the oils as less advantageous. A solution of sea-salt dilutes it equally well, according to J. E. Trempel. Consequently when deafness is produced, as is often the case with persons of a certain age by the accumulation of this substance, one of these liquids is to be introduced daily into the ear by a syringe or by cotton soaked with it, and when softened or detached the mass is to be removed by a *curette*. If fleas, earwigs, or other insects, which sometimes insinuate themselves into the bottom of the auditory canal, are not caught in the cotton and pitch, already prescribed by Hippocrates, or the pencil of lint covered with turpentine which is presented to them for the purpose of entangling them, we may attempt, like Hameck, to kill them by pouring in upon them oil of bitter almonds, or, like Rhazes, a decoction of peach leaves. A decoction of the sedum palustre, used by Acrel, produces the same effect. But it is unnecessary at the present day to combat Verduc, who maintains that the rennet apple has the property of extracting them; or Leschevin, who boasts that a small piece of potatoe is a special antidote against the earwig. It is proper at first to attempt their extraction, whether living or dead, with the forceps.

As to foreign bodies of a considerable volume, which Paulus Egineta has correctly ranged in two distinct classes, the first, those which absorb humidity and may become swelled in the parts, and the second those which are impermeable, they deserve all the attention of the surgeon. Violent inflammation, abscess, caries of the bone, cerebral symptoms, and severe pains of the head, may be caused by their presence. On opening the body of a patient who had died in this manner, Sabatier found the petrous portion of the bone perforated, the dura mater inflamed, an abscess, and a ball of paper in the substance of the bone itself. In the case of a girl, who had been long subject to convulsive fits and nervous symptoms of every description, F. de Hilden obtained a complete cure by extracting from the ear a foreign substance, which had been introduced into it seven years before. An analogous observation is related in 1829, and scientific compilations are crowded with similar examples. M. Larrey, however, remarks, that in a soldier whom he attended, the foreign body remained in place for ten years without producing any unpleasant symptom. It should not be forgotten that these several substances, which are sometimes a bean, a pea, a cherry-stone, a shot, a piece of glass or corn, a pebble, &c., sometimes come out of themselves after the first symptoms pass off, and after producing suppuration more or less profuse. It is important to remember, especially in practice, that the patients and their relatives often

insist strongly that the ear contains a foreign body, when in fact it is completely clear. A terrified mother brought her child, of about five years of age, to one of the public consultations in the capitol, to have a cherry-stone removed which had been twenty-four hours in the ear. Attempts of every kind, uselessly renewed every morning for three days, caused excessive pain, inflammation, and fever; and when, not daring to do anything further, the surgeons thought to ascertain whether if the organ of the little patient really contained a cherry-stone, they found nothing of it. Such instances of inattention have often given rise to the most serious consequences. M. Boyer gives two examples, and there are few surgeons who have not had occasion to observe similar cases.

If inclining the ear be insufficient to extract the foreign body, we must endeavor to reach it with forceps when its form is long and flattened. A small hook is sometimes best for extracting those which are somewhat soft. To such as these relates the advice of dividing them, and reducing them to small pieces with a long and narrow blade of wood so as to remove them piecemeal. Brittle bodies require much more precaution. A false pearl, says M. Boyer, being broken in the auditory canal by a surgeon in attempting to extract it, put the life of the patient in danger, and actually produced suppuration of the tympanum and loss of hearing. In such a case a small but solid curette should be used to look for it, following the inferior wall of the canal so as to conduct it beneath the body to be removed, to be then used as a lever of the first kind by depressing the handle at the moment of extraction. A cherry-stone, which had resisted these manœuvers, at length terminated in the ear, so that if we are to credit M. Donatus, it was extracted by the sprout; but I need not expose the improbability of such a fact. The process of F. de Hilden, adopted by C. de Solingen, has been justly put aside; it consists in carrying first a canula upon the foreign body, and then through this a second one designed to fix it by means of teeth at its extremity, while a kind of gimlet is inserted, and the whole withdrawn together. What cannot be done with the curette, will not be attained by this apparatus, which is better adapted for pushing the body into the cavity of the tympanum than for extracting it. In difficult cases, Paulus made a crescentic incision behind the concha, in order to penetrate to the bottom of the canal, opening the cartilage from without inwards, so as to be able to push the foreign body from within outwards with an appropriate instrument. This operation, which was also proposed by Dionis and Verduc, is now totally abandoned. Perhaps, however, it should not be rejected entirely, when danger presses and all other means have been fruitless. For the rest, whether this or that instrument be used, it is always proper, before commencing the operation, to drop a little oil into the ear to lubricate the parts and render them less irritable. Afterwards nothing more is necessary than emollient injections for some days, at least whenever the manœuvres employed excite no fear for the future development of formidable symptoms. Otherwise, antiphlogistic, hypnotic, and soothing medicines become indispensable.

§5. *Polypi.*

The several kinds of treatment to which polypi of the nasal fossæ have been subjected, have also been presented for those of the ear. Aranzi con-

tends that they are to be cured with caustics, especially with an ointment of red precipitate. De Vigo employed against them by turns, hot iron, caustics, the ligature, and the forceps. Paul removed them with a bistoury made expressly for the purpose, or rather with his *pterygotome.* G. de Salicet cauterized the root after tying them with a horse-hair or silken thread. At the present day the ligature and extraction are almost the only methods used. The ligature, which F. de Hilden, and after him Marchetti and Purmann applied by means of a silver plate bent to the form of a forceps, is rendered easier of application, says C. de Solingen, by piercing the base of the tumor as a preliminary with a thread in the manner of a hook. It is really applicable but in a small number of cases, when the polypus is redunculous and narrow, and near the external opening. It is performed with a hempen thread, and the canula of Desault, or rather after the process of F. de Hilden, modified by Solingen, or again by carrying with forceps a slip-knot or noose of thread, making it glide over a stylet to the root of the polypus. When the thread is placed in any manner whatever, its two ends are passed through a serre-nœud, and after this there is nothing particular in the operation. Excision is practicable under the same circumstances, and in almost every case in which the ligature can be tried. The polypus being engaged on a hook, it is drawn forward, turning it back a little to expose its root, which is divided with a single stroke of the bistoury. As to extraction, the only method, in my opinion, which can be usefully applied to polypi whose root is deeply seated, and which may also be considered applicable to the others, is effected with ordinary forceps with pierced blades, being concave, thin, and furnished with teeth.

The *speculum auris* of G. Fabricius, and that of Cleland, as well as all that have been proposed before or since, are unnecessary if not prejudicial. The forceps supersedes them. The surgeon opens them moderately, and engages them between the tumor and the parietes of the canal, which he gently separates, thus entering them as deeply as possible, and after securing a grasp of the polypus, turns them upon their axis and extracts the whole, half drawing, half twisting them. The blood which immediately escapes conceals the parts in such a way, that most frequently the exploration necessary to render it certain if any thing more exists or not in the auditory canal, has to be deferred until the next day. This hemorrhage is never dangerous. A tent of charpie smeared with cerate, or a dossil of lint, to prevent the bleeding surfaces from being irritated by contact with the air, form all the dressing required, and that which is always employed after extraction of polypus of the ear. In case some heterogeneous tissue remains after the operation, before it increases we should attempt to destroy it either with hot iron, as prescribed by G. de Salicet, F. de Hilden, &c., or with caustics, which are generally preferred at present. The canula of J. de Vigo, open on the side, permits, it is true, the fire to be carried on the diseased point; but as we have sometimes to act upon large surfaces, or very near the membrane of the tympanum, actual cautery in this place is not without danger. Nothing is more simple, on the contrary, than to reach the polypus through the same canula, with a pencil charged with butter of antimony, the nitrate of mercury, or any other caustic, supposing even that the lapis infernalis might not take the place of these several means. Polypi of the ear are developed so slowly, and produce so

little derangement of function, that many patients carry them for years before requiring the assistance of art. At this very moment (February, 1830) I have just extracted one at the hospital St. Antoine, from an adult who had carried it for fourteen years. Extraction in this case is not without danger. The tympanum, deprived for a considerable time of the action of its natural stimulants, becomes irritated by their presence, if suddenly restored without precaution. It is the same as with an eye just operated on for cataract; it must at first be kept in darkness; and exposed to the light but by insensible degrees.

Art. 2.—Internal Ear.

§ 1. *Perforation of the Membrane of the Tympanum.*

Plemp is the first, I believe, who maintained that the hearing might be preserved although the membrane of the tympanum were perforated. The fact which he adduces in support of his assertion, appeared at the time so extraordinary, that Verduc refused to give it credence; and Valsalva, who mentions experiments tried upon animals, also rejected its possibility, notwithstanding the authority of Riolan, supported by the case of a deaf and dumb person, who having plunged an ear-pick through the membrane of the tympanum, was suddenly restored to hearing. But J. Munnicks, and more particularly Cheselden, having again brought it forward, sustaining it by new observations, it must be received as a demonstrated truth. Cheselden did more; since, says he, the loss of the membrana tympani does not bring on deafness, one might perhaps, by perforating it when thickened or degenerated, in some cases restore the faculty of hearing. Unfortunately the criminal in whom he made the application of this idea, was deaf from another cause, and his operation was without success. Although taught again of late by M. Portal, and formally proposed by Busson, as a means of evacuating abscess of the tympanum, perforation of the membrane could only be revived effectually by Sir A. Cooper, who first practised it with success in 1800 and 1802. Attempted since with various results by a number of surgeons, it has yet to take rank among the useful and regular operations of the healing art. A small trocar slightly curved is the only instrument used by Sir A. Cooper, who, to avoid the malleus and the chorda tympani, correctly advises the membrane to be pierced in its anterior and inferior fourth. Himly, who pretends to have publicly described this perforation in the year 1797, says that the opening made with the trocar soon closes, and to prevent this, it should be performed with a hollow punch, which M. Fabrizi, of Modena, intending to modify, has singularly complicated. According to this remark, the cataract needle, preferred by Arneman; the little square knife like Key's needle, with which Buchanan thought to divide the fibres transversely and favor the retraction of the lips of the wound; the triangular sound of Paroisse, and the kystitome cache of Fusch, should all be proscribed; as also the little punch with circular shoulder to prevent its passing too deeply, invented by Rust; a knitting needle, which according to Michaelis might also be adopted; the simple stylet of M. Itard; the needle which M. Saissy encloses in a small tube of gum-elastic; and the kystitome of la Faye, which seems at least to me more con-

venient than any other instrument. For the purpose of securing a permanent opening, M. Richerand thought it would be better to perforate the membrane of the tympanum, by cauterizing it with a pencil of lapis infernalis, and Zang suggested the idea of leaving a piece of catgut in the wound. To the three successful cases of Sir A. Cooper, may now be added a great number of others. That of Saunders, for instance, who cured by this operation a deafness of three years' standing; another, of Paroisse, in a patient who had been deaf for eight years; those of Michaelis, Rust, Itard, Saissy, Maunoir; and those of Henrald, who declares that he succeeded twice in three attempts; but it must not be dissembled, that the most of these practitioners, Celliez and M. Itard, among others, and M. Dubois, at four different attempts, have also performed it without deriving the least advantage from it. Trury and Kauerz have not, I believe, been more fortunate, and besides, it is only proper in very few circumstances. It would be wrong to expect any thing from it, for example, when the deafness is caused by a lesion of the labyrinth or of the middle ear, the nerves, the small bones, or their muscles; in a word, whenever the disease does not arise from pure and simple obliteration of the Eustachian tube. Its design, in fact, is to allow an entrance into the cavity of the tympanum and the mastoid cells, and no other indication can be fulfilled by it. Pus, serosity, mucus, and other liquid matters, the discharge of which it might favor, would find a more natural route by the pharynx, if the trumpet were not closed; and the perforation of the tympanum should be rejected as long as it is not indispensable, or when it is possible to penetrate to the middle ear by any other way. This is not because it is dangerous, or that it may occasion very serious accidents. As it is scarcely painful and rarely followed by general reaction, nothing forbids its being tried when nothing further is to be expected from other means; but we must not promise ourselves too brilliant results from it, or found upon it too sanguine hopes. Simple puncture is of no value; the opening is often closed in a day. Excision itself does not place it beyond risk of this ill result, for the lack of a proper instrument. The hollow punch of M. Deleau, a kind of sheathed spring which expands at the will of the operator, and which suddenly pushes against each other two small cutting circles so as to detach neatly a disk of the tympanum, although one of the most perfect, is far from being always successful.

§ 2. *Perforation of the Mastoid Cells.*

When in consequence of violent or even chronic inflammation, lively, dull, or tensive pains are experienced in the ear; when there are strong reasons to believe that an abscess is formed in this part, or that injections into the cavity of the tympanum would be advantageous, or that caries exist, or some splinters of bone which should be removed, perforation of the mastoid apophysis seems to be clearly indicated. The passage in which Galen says, that if ulcers of the auditory canal have affected any of the hard parts, it is necessary to make an incision behind the ear, to scrape the bone, or remove the exfoliations, is all that appears to relate to this subject in the ancient authors. But Valsalva has already made the remark, that injections through the mastoid cells return by the mouth. Riolan and Rolfinck expressly assert it. Heuermann, who saw an abscess of the ear point at the mastoid apophysis, and there

leave a fistula, concludes from it, that it would be best in such a case to apply the crown of a trepan behind the concha, without giving time to the pus to affect too deeply the spongy tissue of the apophysis. A patient was advised by J. L. Petit, but could not be induced to submit to this operation, while by this means the same author has saved a number of others who were at least as seriously affected. Observations of the same kind have been published by Morand, Martin, &c. It was chiefly on these that Jasser relied in operating on the soldier, in whom he opened the mastoid process of one side containing an abscess with caries, and that of the opposite side for simple deafness. Fiedlitz performed it with success on both sides, for a woman whom a quartan fever had deprived of hearing. This author, quoted by Richter, relates two other cases not less remarkable. Lœfler, who boasts of it, recommends the use of a perforating trepan, furnished with a ledge to prevent its penetrating too far, and that the soft parts be incised twenty-four hours before perforating the bone, so as not to have an effusion of the blood into the mastoid cells; and lastly, that there be daily injections through the opening, which is to be kept dilated with a leaden sound. Hagstrœm, who however has nothing to boast of from it, enters into more minute details on the mode of performing it than Lœffler, whose ideas he principally adopts. If a fistula exist, says he, we must confine ourselves to dilating it. Otherwise the bone is to be denuded, avoiding the auricular artery, which is usually very near the concha, after which it only remains to open the apophysis from behind forwards, with a gimlet, a punch, or trocar, rather than with a trepan. Acrel thinks it useless when the bones are sound; and Murray has well remarked that before puberty the mastoid cells, being scarcely developed, it would in reality be to no purpose. The case of Doctor Berger, who died after being operated upon by Callisen and Kœlpin, and in whose cranium no mastoid cells were found, proves that they may also be wanting in adults. Similar facts related by Morgagni, did not deter Prost or Arnemann, who declare they have resorted to it several times with success. Dropsy of the cavity of the tympanum and simple abscess, do not absolutely require it. They are evacuated as easily by perforating the membrane of the tympanum, which is a far less painful and less serious operation. After all it is only in phlegmasiæ, which are accompanied with necrosis or caries, and are inclined to point behind the ear, that we are in any way obliged to have recourse to it.

Manual.—A crucial or T incision, lays bare the whole external face of the mastoid apophysis. After the bone has been scraped, there is applied to it either a perforator, the small crown of a trepan, a gimlet, or a trocar. Care is to be taken to incline the instrument a little forwards and upwards as it penetrates. When it has reached the auditory cells, it is to be withdrawn to permit the operator to enlarge the opening immediately if necessary. Injections are then to be cautiously thrown in. Tents, dossils of lint, or a sound of lead, should be daily placed in the perforation until the cavity of the tympanum have returned to its natural state. The scissors, or the gouge and mallet, used by J. L. Petit are to be preferred if the bone is widely necrosed, and if it is necessary to separate large fragments. If nothing indicate beforehand where the instrument is to be applied, it is from six to eight lines above the summit of the apophysis. The largest cells correspond to this point. The auricular artery, which is found in front, and the sub-mastoid, which is below, may be easily avoided.

§ 3. *Catheterism of the Eustachian Tube.*

The idea of penetrating into the cavity of the tympanum through the pharynx is already very ancient. Archigenes, Vasalva, Munnicks, and Busson, without doubt had it in mind, when they advised the vapor of water, tobacco, &c., to be inhaled, and the nose and the mouth to be tightly closed to force them towards the ear during expiration. In 1724, Guyot, postmaster at Versailles, and Cleland, in 1741, invented each an instrument for injecting the tubes, one by the mouth, the other through the nose. The slightly curved sound of J. L. Petit, rendered the operation still more easy. Douglas and Wathen decided in favor of the process of Cleland. Heuermann and Ten Haaf, adopting that of Guyot, introduced a female catheter into the tube through the mouth, above the velum palati, and then screwed a small syringe to the other extremity of the tube. It is further recommended by Falkenberg, Sims, Chopart, and Desault; by Callisen, who performed it sometimes through the nose and sometimes through the mouth, and describes very well its mechanism; by Buchanan, Itard, Boyer, Richerand, &c. Proscribed as inapplicable to the living subject by B. Bell, and as dangerous by Trempel, these injections have been brought into vogue again and highly recommended by M. Deleau, who appears to have effectually obtained from them the happiest results. As a mechanical means they remove obstructions of the tube; as medicinal, they act with efficacy upon inflammations, engorgements of all kinds, thickened matters, and fluid collections in the cavity or guttural canal of the tympanum. It is therefore perceived of what benefit they may be in deafness, which depends on any of these causes.

No doubt we may, and that very easily, penetrate the tube by carrying a bent sound through the mouth above, behind, and on one side of the velum palati, as it was done by Heuermann; but the operation being still more easy, and especially more certain through the nasal fossæ, this is the way generally followed at the present day. The instrument of Saissy, Itard's sound, shaped like an Italic *S* or rather an *algalie,* which differs from a female catheter only in being open at both extremities without any holes on its sides, and a small syringe to force up liquids are all that it is necessary to procure in this case. A gum-elastic sound, supplied with its stylet and suitably curved; a buttoned stylet, in case the obstacles are removed by a solid body, may, strictly speaking, take place of other catheters. The surgeon, placed on the side and in front of the patient, bends back the head with one hand, takes in the other the sound smeared with some unctuous substance, presents its beak to the orifice of the nose, and causes it to glide over the floor of the nasal fossæ through the inferior meatus, taking care to keep its convexity towards the septum, and a little inclined upwards. Arrived at the superior face of the velum, he raises a little the extremity of the instrument without letting it quit the external wall of the nostril, which carries it insensibly upon the superior part of the maxillary meatus; he continues it in this direction, and infallibly enters it into the mouth of the tube, which from thence looks obliquely outwards, backwards, and upwards. As soon as the sound is sufficiently engaged, the syringe is fitted on as for injecting a hydrocele, and every body knows what then remains to be done. The operation is renewed once or twice a day, and, as

it is plainly seen, nothing prevents the entrance of any medicated fluid that may be deemed necessary into the middle ear. If the injection be arrested in the tube, and from some cause cannot be made to advance, it will be a case for removing the syringe and passing up the stylet as far as the obstacle, so as to remove or destroy it. But in this place force is not to be used but with great caution; and before having recourse to it, we should be well assured that it is indispensable—that the best directed manœuvre cannot supersede it. M. Deleau, who obtained the happiest results from this kind of medication, finding that the beak of the metallic sound would not fail of soon striking against the parietes of the tube when an attempt is made to advance it some lines, that its inflexibility creates pain, and that aqueous injections penetrate thus with great difficulty into the auricular cavity, thought to substitute for it a flexible sound and to force in atmospheric air. With the processes of this surgeon the operation is possible at every age. He even succeeded in passing his sound by the nostril opposite the diseased ear; which is an extremely happy thing when any alteration or deviation prevents its being carried through the corresponding nostril. I have seen two boys, one four, the other seven years old, submit with a very good grace to the manœuvres of his method, and without giving the least sign of pain. By means of a silver stylet from four to six inches long, with a strong curve near one extremity, carrying a ring at the other, the diameter of which varies from a line to a line and a half, he conducts a gum-elastic sound to the tube. The patient seated on a chair leans his head a little backward, supporting it on the back of his seat or against a cushion made for the purpose, and supported by a staff which may be lowered or raised at pleasure. The operator takes his instrument, previously oiled; presents it to the nostril, holding it like a pen in his right hand, with its concavity turned downwards and outwards; enters it, rapidly following the floor of this cavity soon touches the palatine vault (which is known by an involuntary movement of deglutition, and by the instrument's having arrived at the depth of two or two and a half inches); raises its beak outwards and upwards by a circular or rotatory motion to bring it into the tube; then seizes above, with the thumb and index finger of the left hand, the free extremity of the catheter, if it is engaged within the tube; attempts to make it advance while the stylet is kept immovable by the right hand; moves it thus as far as the obstacle, which it removes as a coarctation of the urethra is removed, and withdraws the conducting stylet when he thinks he has entered sufficiently far; screws a silver pavilion to the external orifice of the canula, which he retains in place with a wire twisted in the shape of forceps, which embraces at the same time the corresponding ala of the nose; fits to this pavilion the beak of a syringe, a bottle, or bellows of gum-elastic; uses it to force the air beyond the obstacle, not exceeding a degree of pressure which habit alone teaches to proportion; discovers by the noise which is heard in applying the ear to that of the patient whether the cavity is sound or diseased, empty or full, whether the gas which is forced in can or cannot return between the sound and the parietes of the tube; substitutes the tunnel of a reservoir furnished with a manometer, in which there is a pump to compress the air; turns the stopcock of this apparatus, and establishes a double atmospheric current in the ear, one *entering* by the sound, the other

issuing between it and the guttural canal, augmenting or diminishing the force of this injection, and stops in the course of one or several minutes.

Remarks.—In penetrating through the opposite nostril the instrument is a little more curved, and its beak is slightly bent again in the direction of its main convexity. Held in the same hand, its concavity turned downwards and inwards, it is made to pass along the inferior margin of the septum. When at the velum palati, the hand is elevated by carrying it outwards, to incline its extremity behind the vomar and reach the tube; the rest is performed according to the directions already laid down. In the one case as in the other, if the sound is not well placed, the patient himself makes it known after he has once undergone the operation. Its direction and position otherwise sufficiently announce it to the surgeon. For positive assurance, however, there is an easy means. The stylet being withdrawn, air or a liquid is to be thrown through the canula; the injection will fall into the pharynx if the position is wrong, and in the contrary case will either not pass or will enter the cavity of the tympanum. M. Deleau is of opinion, that by passing the sound briskly though gently forwards, there will be less hindrance and fatigue than by the common method. Experience has demonstrated to him that there is less inconvenience in beginning again once or oftener, and turning the beak rapidly towards the tube, than in feeling slowly about it to find its entrance. His flexible canula has a very great advantage. Pushed forwards by the fingers of the left hand while the stylet is held without, it enters and adapts itself to the direction and bendings of the canal to be traversed. From the pressure it meets with in advancing, we perceive at what distance the contraction exists; what is its degree, and even its density. If the first instrument used appear too large, it is replaced by a smaller, and *vice versa.* The curvature of the inflexible sound allows nothing of this; with it the injection is thrown more or less obliquely against one of the walls of the canal; the other directs it, on the contrary, in the axis of the tube. If after the removal of the obstacle the air makes a hissing noise in the cavity of the tympanum upon the membrane, or a dry sound, the conclusion is that the middle ear is not affected; if it seem rather to agitate a liquid, if it is *mucous,* we are authorized to infer that there exists pus, blood, serosity, or at least an engorgement of the internal membrane of the middle ear. In both cases, if the tube is evidently obstructed or contracted, and the patient has better perception of sounds immediately after than before the catheterism, the deafness depends on the condition of the tube, and there is every reason to believe that it may be removed. When no change results, the evil probably lies elsewhere; and we may be pretty certain that in the end there will be no advantage derived from this operation. Sharp pain produced by the injection announces an acute phlegmasia, or too great nervous irritability, which is to be overcome by the usual treatment. In simple obstruction or purely chronic phlegmasiæ, there is scarcely any pain during the operation. M. Deleau explains the action of the air in a manner altogether mechanical; it sweeps out, blows, and cleanses by degrees the cavity of the tympanum and the mastoid cells. In returning between the sound and the tube it necessarily makes an effort, and becomes a dilating and resolving body by the compression it exercises on the engorged tissues. Water and other liquids produce no other medical effects than gases, and are much more apt

to wound and rupture the membrane of the tympanum. Every professional man will, however, understand that each case may require special modifications, and that it is the same as far as relates to the operative process in contractions of the Eustachian tube, as in coarctations of the urethra; and that on this point dexterity and frequent practice, joined with great prudence, will alone give sufficient skill to him who wishes to reap any fruit from catheterism of the guttural auditory canal. It would consequently be vain to expect to attain the knowledge and tact possessed by M. Deleau, without long practice. Thus does it become a very simple matter how this practitioner has succeeded in affording relief or cures to a host of deaf and dumb, who had fruitlessly sought elsewhere the amelioration procured in his establishment.

It remains for me to offer a suggestion. As engorgement, thickening, or a phlegmasiac condition of the mucous lining of the tube is admitted as a cause of deafness, might it not be allowed to try against this affection what is employed with so much advantage in the radical cure of it in the urethra, viz., the nitrate of silver? Having no authority in support of this suggestion, I merely throw it out in passing, without forgetting the fear naturally inspired by the introduction of caustics through the pharynx into the ear.

TITLE II.—OPERATIONS ON THE TRUNK.

CHAPTER I.

Neck.

SECTION I.

Lateral and Superior Regions.

Art. 1.—*Parotid Gland.*

To take literally what has been said by the authors of the last century, nothing should be so simple as the total eradication of the parotid gland. In our days, on the contrary, nothing seems more difficult; so that many great masters, M. Boyer among the rest, deny even its possibility. It is true that the greater part of reported cases are far from being conclusive. Thus, as Richter has already remarked, and Burns demonstrated, the assertions of Heister, who is said to have extirpated the parotid several times; those of Scultetus, Verdier, Palfyn, Van Swieten, Gooch, Berh, Roonhuysen, Gottefried, Errhart, &c.; of Garengeot, who maintains that the operation never causes hemorrhage; of Kaltschmidt, who avers that he performed it a number of times with success, among others for a tumor which weighed three pounds; of Acrel, who arrested the hemorrhage by simple tamponnement; of Burgraw, of Hezel, of Alix, who removed a mass weighing four pounds from

beneath the ear without producing the least effusion of blood; of Kauw, Boerrhaave, and some others; evidently relate to the removal of lymphatic tumors developed in the depth of the parotid space, and not to the parotid itself. Might not the same be said of the following observations? In 1781, J. B. Siebold thought that he had entirely removed the parotid, because after the operation it was easy to discern the digastric and stylo-hyoid muscles, as well as the carotid artery. In the case of a student, mentioned by Heister, it was necessary to go so deep that the carotid gave rise to a fatal hemorrhage. Thinking to remove a wen, Soucrampe perceived that he was extirpating the parotid and continued his operation, dissecting out the gland with a bistoury. "I guided the instrument," says he, "with the index finger of the left hand, to distinguish the pulsation of the arteries and especially of the carotid." Less blood was lost than the surgeon expected, and the patient was perfectly restored. In 1796, Ch. G. Siebold, who removed an enormous tumor from the side of a young lady's neck, says, that there resulted so deep an excavation that all the assistants were obliged to admit that the parotid gland had been extracted entire. In an operation by Klein, in 1820, the facial nerve was cut. It was necessary to lay bare the carotid artery and the pneumogastric nerve, to turn aside the temporal, external maxillary, auricular, and transversalis faciei arteries, and tie several of these vessels. At the end of eighteen days the cure was complete. In the case which occurred to M. Idrac, of Toulouse, there was no artery to tie, but the wound presented the same aspect as in the patient of the elder Siebold, and the diseased portion, as large as the fist, was round and rugose; inwards was a projection moulded in the space bounded by the mastoid process, the auditory canal, and the margin of the jaw. It was of the same nature throughout, and presented exactly the form of the parotid. The patient was cured without the occurrence of paralysis. The observation of M. Lacoste differs from that of M. Idrac only in having an abundant hemorrhage, twice renewed, and which placed the life of the patient in danger. The tumor removed by M. Prieger weighed nearly three pounds. The external maxillary, temporal, and auricular arteries, but not the carotid, were divided and tied. The woman survived. If we are to believe Mr. Kirby, we may be assured that after his operation the interval of the pterygoid muscles was empty, the auditory canal displayed as well as the temporo-maxillary articulation and the whole length of the styloid process. Nevertheless, plugging with sponges sufficed to arrest the hemorrhage; and notwithstanding an erysipelas of the face which supervened, the patient was cured. As to the case related by M. Pamard, the author himself admits that the parotid was not entirely extirpated. M. Nægele maintains that the gland may be removed from the dead subject without lesion of the facial nerve, and declares that he has performed it successfully in his hospital without producing paralysis. If in these various observations the authors are far from giving all the details, and all the proofs capable of carrying their own conviction to the minds of their readers; if in several instances the little they do say tends to prove the contrary of what they have advanced, it is not, therefore, the less probable that some among them refer really to the eradication of the principal secretory organ of the saliva. Besides, there actually exist irrefragible proofs of such an operation. Although M. Goodlad reports a case quite circumstantially, yet to Beclard is due its first demonstration. His patient, operated

upon in 1823, at the hospital La Pitie, had the muscles of the whole of one side of the face paralysed, and, as he died some months after of chronic meningitis, it was in the power of the operator to prove on the dead body that all the gland had been positively extirpated. A patient, who was operated on by M. Gensoul, in September, 1824, and died in the course of the year 1825, if we admit without reserve the assertion of the author, proved also that the removal of the parotid gland had been complete. With better fortune than at first, M. Gensoul repeated the operation in 1826, and with full success, but the patient remained with paralysis of one half of the face. M. Carmichael met with the same good fortune some time previously, that is, in 1818, and mentions the same peculiarity as M. Gensoul as the consequence of the operation. In 1826, also, M. Lisfranc had occasion to remove the whole of the parotid, and exhibited the patient and the morbid portion to the academy, and proved satisfactorily after death, which happened after the lapse of some weeks, that there was no portion of the gland remaining in the parotid space.

In the operation performed by M. Heyfelder, of Treves, in the month of June, 1825, the patient lost but three or four ounces of blood, but a very small lobe of the gland was left in front, and the paralysis of the face in the end spontaneously disappeared. In the operation by Dr. G. M'Clellan, in 1826, the success, says the author, was complete, although the gland was entirely removed. That of M. Cordes, of Hirschetrg, who declares that he did not leave the least particle of the gland, is equally established. M. Bernt professed also to have performed it with success. The Archives contain another example, in which layer by layer was removed down to the carotid. The German journals of the last year report a new case of the successful removal of the parotid. In the operation which M. A. Fonthein de Syke performed, in November, 1828, on a woman twenty-three years old, the carotid was not wounded, no hemorrhage took place, and the cure perfect on the thirtieth day. The paralysis itself, which was apparent at first as in the preceding cases, had completely ceased. The most recent case that I am acquainted with, is that of M. A. Magri, of Soreinese. In January, 1829, this surgeon, assisted by M. Madonini, extirpated from the side of the neck a tumor which included the whole of the parotid, without being obliged to tie the trunk of the carotid. The patient, a countryman, thirty-six years old, was restored in twenty-six days, with the exception of paralysis of the face, which remained. M. Dugied, who gives an extract of the greater part of these facts, mentioned also by Messrs. Hourman and Pillet in their dissertation, says that Messrs. A. Cooper and Weinhold have extirpated several times the entire parotid. But I have not been able to find where these observations have been published, except those of M. Weinhold, who preserves one of the glands in his cabinet. and exhibits it to any one who desires to see it.

Anatomical Remarks.—This gland, which is enveloped in its aponeurosis, and continuous in some measure with the sub-maxillary gland in passing over the internal face of the angle of the jaw, separated from the skin by a layer of adipo-cellular tissue of more or less density, is nearly of a pyramidal shape, and is somewhat firmly connected to the auditory canal above, to the mastoid process and sterno-mastoid muscle behind, and more or less prolonged in front, upon the external face of the masseter. On its anterior face, it conceals or incloses between its lobes, as you go from above downwards and from

without inwards, first, the arteria transversalis faciei, and the two principal branches of the facial nerve at the point of their passage over the margin of the jaw; secondly, parallel to this margin, the superficial temporal artery and vein; thirdly, the external carotid and the origin of the internal maxillary; and fourthly, the pterygoid muscles, and some branches of the pharyngeal vessels. It rests below upon the stylo-maxillary ligament, the digastric and stylo-hyoid muscles; behind, between the ear and the mastoid process, upon the auricula artery; lower down upon another quite large branch, which crosses the mammoid protuberance; more deeply, upon the stylo-mastoid artery, and mediately upon the occipital. By its summit it passes near the internal jugular vein, the great hypo-glossal, the pneumogastric and the great sympathetic nerves, between the transverse process of the first vertebra and the pharynx. One of its branches is generally prolonged between the two carotids; another often advances between the stylo-glossus and the stylo-pharyngeus muscles, the internal carotid artery, and the jugular vein: the whole cover the styloid process, which they embrace, and the root of the anatomical *bouquet* of Riolan. In fine, it is traversed obliquely from above downwards, from within outwards, and from behind forwards, by the trunk of the facial nerve, which ramifies in its substance, where is also found the vein which forms the communication between the two jugulars, very small lymphatic ganglia, and other arterial and venous branches of much less importance.

Manual.—When the operation is determined upon, the first question that presents is, whether it is necessary or not to imitate M. Goodlad, who previously tied the carotid artery? At the commencement, it is never known whether the whole of the gland will have to be removed, or whether we may be permitted to leave a part. If in the first case a wound of the external carotid is almost inevitable, the internal carotid may very frequently be respected. In the second, there is a probability of preserving both. By its action on the encephalon, and the rest of the organization, this ligature is far from being indifferent. Without admitting, with M. Tuson, that proximately or remotely it is constantly fatal, it would at least be very wrong, whatever may be said of it by some moderns, not to regard it as one of the most dangerous operations in surgery. Here, besides, its execution would be extremely difficult on account of the changes of relation between the parts, at least if the external carotid only is to be tied. In keeping the thread around it only during the operation, as was done, or appears to have been done by Beclard, Carmichael, Gensoul and Lisfranc, we have at least the chance of dispensing with it, if it be possible, without being thereby exposed to meet more numerous obstacles, than in any other manner.

1. *Operation.*—The instruments which may be required are a straight bistoury; a convex bistoury; a probe-pointed bistoury; straight and curved scissors; a dissecting forceps; a steel director; a scalpel, of which the flat handle may serve to separate the parts if occasion require; needles armed with ligatures, and all that may be necessary for placing a ligature on the carotid artery. The rest of the apparatus consists of sponges, rolls of charpie, dossils of lint, agaric, long and square compresses, one or two bandages, and other things required in every great operation.

First Stage.—Resting on the sound side and supported by assistants, the patient is to be placed so as to be able to breathe and spit freely. One person

should be ready to compress the trunk of the primitive carotid in case of accident. The volume, the form of the tumor, and the state of the integuments, determine the kind of incision which should be first preferred. If the skin is sound, and free from adhesions; if the body to be removed does not exceed in size a hen's egg, the crucial or the T incision is the best: otherwise recourse must be had to the elliptic incision, in order to remove with the scirrhus a flap of the cutaneous cushion. In this latter case, if the extent of the tumor require it, nothing prevents making on each lip of the ellipse afterwards another incision, which will transform it into a T, and after the operation will reduce the whole to a crucial incision. Unless the disease extends very far towards the mouth, it is less advantageous, without doubt, to make the great diameter of the wound transversely, as done by Mr. Goodlad and advised by M. Fonthein, than perpendicularly. These are the only general rules that can be established on this first point. It is upon himself, his knowledge, and his peculiar ability, that the operator will be obliged to rely in following, modifying, or infringing them.

Second Stage.—The integuments being dissected and the flaps turned back, the surgeon detaches the altered mass commencing at its superior part and on its posterior edge, so as not at first to fall upon the carotid; he ties all the arterial branches as they are opened, or, if they are of inconsiderable size, follows the precepts of Zang, leaving them to be compressed by the finger of an assistant, observing when about the margin of the maxilla or near the pterygoid muscles, to keep the edge of his knife rather backwards than forwards, directed against the tissues to be extirpated rather than towards those which are to be preserved. When the handle of the scalpel is sufficient, it ought to be preferred. With this instrument most of the lobes of the gland may be torn loose and insulated, and disengaged from between the vessels, without any risk of wounding the arteries, and the dangers of the operation are by so much diminished. However, when it is certain that the adhesions to be destroyed contain nothing important, the bistoury is to take the place of the scalpel. By tearing, the dissection is more certain; by incision, it is quicker, less painful, and more favorable in the sequel. Behind the ramus of the jaw, the operator is to redouble his precautions. There, are located the external carotid, completely enveloped with glandular granulations, in some subjects, and the origin of the temporal and internal maxillary. Deeper, at the apex of the parotid fossa, if any pedicle exist, or any portion that cannot be removed by the handle of the knife, prudence dictates that a ligature be passed around on the side of the sound parts before cutting them. Supposing that during this operation a large artery, the external carotid for instance, should be opened, or that its lesion appears inevitable, before proceeding further in the operation it is laid bare towards its origin, that the ligature may be applied low enough to prevent its being touched again during the operation. If the muscles of the styloid process, the digastric especially, have not degenerated, we should endeavor to preserve them. In the opposite case, they are sacrificed without hesitation, as also the trunk of the facial nerve, which it is useless to attempt to save when the entire parotid is disorganized. In the end, it is possible that the gland may resist only at its summit; and notwithstanding the tractions exercised by the left hand on the one part, and by the handle of the scalpel on the other, this point holds firmly at the bottom of the

wound. Then, for fear that it contain some large vascular trunk, it is best to include it in a ligature and strangulate it as in the case of a polypus, conforming to the advice of Hezel, and confining ourselves at the moment to the excision of the free part of the tumor only.

Remarks.—The arteries which may have to be destroyed, are, besides the carotids, the transversalis faciei, the temporal, the auricular, the mastoid, the stylo-mastoid, the occipital, the internal maxillary, the inferior pharyngeal, the lingual itself, and the facial. It is necessary, therefore, to tie successively all these branches, if their common trunk has not been previously secured. The blood which continues to flow afterwards, can only come from the veins, and requires no other care than the application of a compress, if it do not cease spontaneously. At first sight, the excavation which has been produced has something frightful in it, but its depth alone does not prove that the whole gland has been extirpated. In swelling, the ganglia which are in the centre or at the borders of this organ, force it in every direction, produce in it atrophia, and cause it in some measure to disappear, so that after their removal, it is very easy to be deceived, and to believe that the parotid itself has been extirpated. It is a remark on which Messrs. Murat, Cullerier, Richerand, and Boyer justly insist, which it is important not to forget; and which allows us to estimate at their true value the assertions of authors whose observation I have noted above, and to understand how this operation can be performed without producing hemorrhage, by dividing only the smaller vessels, &c. If the wounds be but of few inches in extent, the flaps may be approximated, and united by strips or the suture. But when it is very broad, by attempting to close it immediately and fully, it is liable to purulent discharge, to simple or phlegmonous erysipelas, and all their consequences, as was seen in the cases reported in the name of Beclard and several others. After cicatrization the patient may remain weak, and he should be apprised of it beforehand. The motions of the pharynx, of the larynx of the tongue, of the jaw itself, suffer sometimes greatly from this operation on account of the division of the muscles. Most frequently the division of the facial nerve paralyzes more or less completely the eye lids, the ala of the nose, the labial angle, and all the corresponding half of the face. In time, however, the most of these parts recover their powers, and it is rare in the end that the countenance does not resume its former expression.

2. *Ligature.*—The cutting instrument is not the only means in the hands of practitioners to destroy the schirrous parotid. Intimidated by the dangers of hemorrhage, Roonhuysen, who had already proposed to substitute the ligature, passed a double ligature deeply through the base of the tumor, and tied its two portions separately, the one above and the other below, so as to produce mortification of the diseased tissues by depriving them of all circulation. M. Mayor recommends that it be first exposed, as if for its extirpation; and after insulating all the portion which makes the projection externally, it is traversed, as by Roonhuysen, or rather it is drawn outwards as much as possible with a hook-forceps, and a strong ligature is passed beneath its root, which is gradually tightened by his chaplet-constrictor. In five or six days, says he, the degeneration is entirely cut off or reduced to decay, without risk of the lesion of any artery. In this manner he cured a girl, fourteen years old, of a tumor which had existed for three years in front of the ear; and another

person eighteen years old, upon whose person the gland extended from the zygomatic arch to beneath the angle of the maxilla; and again, a third on whom the morbid mass, eight inches long and four broad, was situated in the parotid region. But whatever may be said by this author, these facts relate rather to the extirpation of degenerated lymphatic gangliæ than to that of the parotid gland, properly called. I observe, besides, a disadvantage in this method; it is likely to remove but a part of the disease when it is deeply seated, and if it be superficial, as the use of the bistoury then ceases to be formidable, it loses much of its importance. However, in the first of these cases I would willingly try it in combination with dissection. Without the trouble of extracting all the branches of the gland, one after the other, a strong ligature which would include them *en masse*, and allow them to be gradually strangulated, seems to offer a resource which has been too much neglected, as M. Mayor justly complains.

3. *Caustics.*—The advice of Desault and of Chopart, who require that after excising all the projecting part of the scirrhus the rest shall be destroyed with hot iron or caustics, is assuredly of the very least value, and scarcely deserves to be noticed. Cautery could not be useful in this operation, except to close the mouths of vessels escaped from the ligature, and to consume some morbid particles, if any have been left by the instrument against the intention of the operator.

Art. 2. Submaxillary Gland.

No conclusive observation proves that the submaxillary gland ever passes to the state of scirrhus or cancer. The cases which have been reported refer to the conglobate glands which border on it, and are found between it, the margin of the jaw, and the platysma myoides. Its induration in consequence of chronic inflammation, in ranula, for example, is far from being equally rare. Abscesses developed in the cellular tissue of the surrounding parts, and which remain fistulous after being opened, also produce it. But however obstinate it may be, this disease generally yields to other means than extirpation, which, to me, does not appear altogether indispensable. Of the two cases of it which were published in France some time since, the one which I reported and which belongs to M. J. Cloquet, was a pure and simple case of the extirpation of sub-hyoid ganglia; the other, related by M. Amassat, belongs probably to the same class, and, by the way, it is far from being demonstrated that the operation in this case was absolutely necessary. Whether the disease is seated in the gland, or the ganglia which surround it, the process to be followed in its removal is nearly the same. Embraced as it were inferiorly by the concavity of the digastric muscle, and separated from the integuments by the facial vein and the platysma myoides, the submaxillary gland rests superiorly against the internal face of the jaw, and inwards against the hyo-glossus and the mylo-hyoides muscles, upon the external face of which it sends one of its prolongations. The facial artery coasts along its superior and internal side; the lingual nerve and artery pass beneath. Quite high up it receives the plexus of the myloid nerve.

Manual.—All that has been said of the form and direction to be given to the incision in speaking of the parotid, is equally applicable here. The

patient is to have his mouth closed, the chin elevated, the head thrown back and to one side; the gland of the tumor is thus brought entirely in view. The surgeon divides the skin at first from above downwards, from the margin of the jaw to the os hyoides, and then transversely; he dissects, detaches, and turns back the flaps thus traced out; applies two ligatures upon the facial vein, and divides it between them if it is too much in the way and cannot be kept aside by a hook; inserts a hook into the body of the gland and has it drawn outwards and upwards, then backwards and downwards, while with short strokes he detaches the inferior portion or the anterior moiety; avoiding carefully the lingual artery and the concomitant nerve, he seeks posteriorly the trunk of the external maxillary and ties it; has the hook carried forwards and downwards; separates the morbid mass from the side of the tongue, and removes it without difficulty. If it be preferred to commence by tying the facial artery, the first incision is to be directed over it, and it is to be looked for at the point which I have indicated in another chapter. It may not even be tied at all if care is used to preserve untouched to the end the point through which its branches penetrate the gland, and to embrace it as a pedicle with a strong ligature. As for the dressing and treatment, we are to act as after the extirpation of the parotid, always recollecting, that beneath the jaw immediate reunion presents infinitely less danger, and that the whole of the operation is incomparably less formidable than in the subauricular fossa.

SECTION II.

Anterior Region.

Art. 1.—*Thyroid Body.*

Goitre or *bronchocele* is another tumor with which modern surgery has been much occupied, and which is not to be attacked by surgical means until after having been vainly opposed by iodine, the *powder of Sency*, and the other pharmaceutical resources, extolled at the present day; and if it should become so oppressive to the patient as to endanger his existence. *Caustics*, which were employed for its destruction in the days of Celsus, and since by a small number of practitioners, are no longer in use. The *seton* which the elder Monro, Gerard, and more particularly Flajani, have tried, or seen tried with success, and which M. Quadri, of Naples, recently published as a new resource, does not deserve the same proscription. The advantages to be derived from it are placed beyond doubt by a number of authentic cases, and whenever, instead of hypertrophy, fungous or cancerous degeneration, the tumor is formed by cysts of liquid or semiliquid substances, its application is most rational. M. Quadri applies it in general from above downwards with an instrument analagous to the needle of M. Boyer, and rarely carries it beyond half an inch in depth for fear of wounding the blood vessels. If the mass to be destroyed is very voluminous, he passes through it two, three, and even four ligatures, at different points. The goitre soon begins to shrink, and resolution, which is effected gradually, continues in most cases, even after discontinuance of the seton and cicatrization of the wounds. The thyroid is often the seat of hard swelling. I have met

with scirrhus in it. Burns and M. Wardrop, have there met with encephaloid matter and *fungus hæmatodes*. But the facts brought forward by the Naples' surgeon do not prove that in such cases the seton is able to triumph over the disease. Under these dreadful circumstances there have been proposed, ligature of the bronchocele, its extirpation, or the ligature of the principal arteries entering it.

Ligature.—To Moreau, surgeon of the Hotel Dieu, Valentine attributes the idea of attacking the goitre by ligature. One of the patients thus treated in 1779 was not relieved, the other was perfectly restored. The tumor in the first was cancer, that of the second was of an adipose nature. The surgeon passed a double ligature through its base, so as to divide it into two equal parts, which he strangulated separately. Some years afterwards Desault had also recourse to it, but it was to terminate an extirpation, the last stage of which had become dangerous. Bruninghausen used it with complete success in 1805, to destroy an enlargement about the size of an egg, which was situated in front of the neck between the larynx and the sternum, of a young man twenty-five years old. The science rested at this point until, some years since, M. Mayor carried forward its boundaries; a child twelve years old, upon whom he operated in 1821 for a goitre of the size of an orange, at the end of a month left the hospital in perfect health. On a man twenty-one years of age, the tumor occupied the front and both sides of the neck, extending from the maxillary angles and the parotid region to very near the sternum and the clavicles. Of the three lobes which composed it, the middle was as large as the head of a fœtus of seven or eight months. The whole mass was nine inches in depth, and twenty-six in breadth beneath the jaw. The general health of the patient was bad, and yet M. Mayor cured him radically in less than a month. He was equally successful on a lady, of Sackendorf, who had in vain consulted the most distinguished men of every country, to free her of a tumor which had existed for nearly thirty years. This tumor, which had not ceased to grow, occupied all the left side of the neck, had pushed to the right the larynx and trachea, compressed the carotid artery and internal jugular, and seemed seriously to threaten the life of the patient. His process consists in laying bare the whole anterior face of the bronchocele by a crucial or T incision; then insulating it more or less from the adjacent parts with the fingers or the handle of the scalpel; afterwards to pass a strong ligature round the root of each of its lobes, or to traverse its base with a double ligature, which permits it to be strangulated upwards and downwards. Instead of one or two ligatures he sometimes employs as many as four, which are then to embrace each a fourth or third of the gland. As many constrictors are necessary as there are nooses of thread; and it is to the chaplet-constrictor, as we may well guess, that he accords the preference. From these details it is evident that the ligature here is but an accessory means, a resource against hemorrhage, a kind of make-shift, good to be used when there is danger of wounding vessels of some importance; and that if it were certain that all the large arteries could be avoided, extirpation with the bistoury would be much more advantageous. It is an operation besides which cannot but be a serious one; two of the patients operated on by M. Mayor himself sunk under it. It causes suffocation, angina, difficulty of respiration, and frequently some of the symptoms of putrid fever.

Consequently I would not advise it, but with the condition of first detaching the tumor with a cutting instrument or the fingers to the greatest extent possible, so as to have a pedicle instead of a large base to strangulate; with the condition also of cutting off the tumor without the knot, and not leaving it to putrify in the wound.

Obliteration of the Arteries.—Some practitioners were of opinion that by tying the thyroid arteries they would probably obtain resolution of the goitre. Burns refers the first idea of it to Mr. W. Blizard, of London. The patient upon whom this surgeon operated, did very well for a week, but several hemorrhages, and hospital gangrene soon exhausted him, and finally caused his death. Since then, M. Walther, who conformed to the precept of the English surgeon, in 1814, performed it with full success. To Mr. H. Coates is also due another successful case. Mr. Earle and Mr. Green have not been less fortunate; and M. Boileau, being obliged to tie the carotid for a traumatic lesion, in 1825, had the satisfaction not only of saving his patient, but also of seeing him cured of a goitre of many years' standing. Mr. S. Cooper, however, informs us that a ligature of the thyroid vessels, performed by M. Brodie, produced no diminution of volume in the tumor he wished to destroy. Without being very numerous, these facts are, however, sufficiently conclusive to justify subjecting this mode of relief to new experiments. It ought particularly to be tried in pure and simple bronchocele, or in hypertrophy of the thyroid body. Instead of one or two, in my opinion the four thyroid arteries should be tied, otherwise it is to be feared that the blood which is cut off on one side may return by the other; the more so, as the long continued irritation of the parts has in general produced there a very decided development of the vascular system. After all, the operation has nothing in it which should deter the enlightened surgeon. If the natural pulsations of the vessels are not sufficiently strong to serve as a guide to the instrument, each thyroid artery is to be sought for at its origin from the carotid, the superior on the internal side of this trunk, the inferior by following the rules laid down elsewhere.

Extirpation.—By extirpation the whole of the disease is removed, and the patient promptly freed from it: but this operation is attended with so many and such formidable dangers, that all the members of the old academy of surgery, and the great majority of the authors of the present age, concur in proscribing it. It seems to me probable, however, that we shall soon have cause to form a different judgment. That in the time of Albucasis, a patient who had submitted to it died of hemorrhage, is not very surprising; and that the young woman, mentioned by Palfin, sunk from the same cause during the operation, is also easily imagined. Although one of the patients mentioned by Gooch died, sinking, at the end of eight days, and to save the other it was necessary for assistants to succeed each other constantly during a week, in order to compress with the fingers without relaxation all the arterial mouths which had been opened; although an officer, whose case is told by Percy, died also of hemorrhage, and the patient of M. Dupuytren survived but thirty-five hours the removal of the tumor; although the cases of extirpation brought forward by Freytag, Vogel, Theden, Desault, Giraudi of Marseilles, M. Fodere, and the barber who, according to Paradi, performed it with success on his wife, are not all very conclusive; although the girl more recently treated by Klein was the next day seized with an apoplexy to which she fell a victim,

it would be wrong to condemn attempts which are intended to familiarize us further with this operation. By combining it with the ligature, as practised so successfully by M. Mayor, and at the same time by M. Hedenus, of Dresden, it cannot be doubted that much success may be derived from it in future. The most complicated cases have not intimidated this last surgeon, who in 1822, had succeeded in six cases. His process differs from that of M. Mayor, in his dissecting the bronchocele carefully with the scalpel to its whole depth, and tying the arteries as soon as divided by the instrument; in this also, that the ligature which he places the same as the surgeon of Lausanne, but ties it as for the obliteration of a large vessel, has no other design than to strangulate what he dares not cut, and to permit him to excise all the morbid mass immediately and safely. For my part I will not decide on the extirpation of a real goitre, until I am assured that it is complicated with no lesion of the heart, no tendency to apoplexy, and that the surrounding lymphatic glands are sound; nor until after having tried either the seton, after the manner of M. Quadri; the simple incision, advised by M. Fodere, and practised with success by M. Delpech; or, as advised by M. Rullier, an irritating injection thrown into the cyst, if there be one; or the preliminary ligature of the thyroid arteries; only at the earnest entreaties of the patient, and when, instead of being merely a deformity, the bronchocele constitutes a disease whose progress and nature threaten more or less imminently the life of the patient.

Manual.—Suppose a goitre occupying every point of the gland. The preparations are much the same as in removal of the parotid. The patient is laid on his back, his head moderately bent back and held by assistants. Placed on the right, the operator makes his first incision on the median line, commencing above and terminating below the tumor; transforms this wound into a crucial incision; detaches the flaps and dissects them as far as their base; divides transversely the fleshy strips, and turns them back to their point of attachment, if they are sound, or, if diseased, includes them in the subsequent excisions; ties the vessels that are in the way; reaches, gradually, the edges of the thyroid body, draws them towards him, tearing rather than cutting; finds, deeply seated, at their superior and inferior parts the four principal arteries of the organ, insulates them, and passes round each a ligature; avoids with all possible care the trunk of the carotids, the internal jugular vein, the descendens noni, the pneumogastric, the great sympathetic, and the cardiac nerves which are to be found a little further outwards, crossed by numerous secondary veins; then detaches the tumor, by its superior part, from the sides and anterior face of the larynx which it surrounds and sometimes deforms, by depressing the thyroid and cricoid cartilages, from which it is separated only by the thyro-hyoid muscles, cellular lamellæ, and some small arteries which it is necessary to tie, furnished by the lingual or maxillary branches; returns towards its edges, which he raises and separates from the œsophagus, then from the trachea near which are the laryngeal nerves; in fine, when it is only held by its inferior edge, if the venous plexus which issue from it, and the thyroid artery of Neubauer, which is frequently to be found there, cause its complete separation to be dreaded, he includes all these objects in a ligature, or rather traverses its pedicle with a double ligature; strangulates them as forcibly and as near their root as possible; after which

he removes without fear the whole of the goitre. A dissection so painful and so delicate cannot be quickly performed. The patient has need of resting from time to time. All pressure on the trachea or the larynx ought to be avoided with the greatest care, and the surgeon should keep in mind that if the inspirations are not free, the blood accumulates in the veins and flows in torrents under the least cut of the bistoury. Before proceeding to the dressing it is necessary to tie the smallest arteries. As to the veins, they will cease to bleed as soon as the patient, freed from restraint, can expand his chest freely and without fear. If it happen otherwise, they are to be tied; which, by the way, is far from inducing phlebitis as surely as some modern observers contend. The convulsive movements, and even death, which have sometimes occurred during the extirpation of tumors accompanied with great development of the vascular system, being attributed by some to the opening of these veins, it has been supposed that bubbles of air, penetrating thereby, have been carried to the heart and caused these frightful effects. Experiments upon animals, related by M. Magendie; M. Larrey, who declares that he saw a puncture of the external jugular prove suddenly fatal, gave the first idea of this theory. An accident that happened at Hotel Dieu under the knife of M. Dupuytren, another of the same kind experienced by M. Græfe, and a third by Dr. Mott, have seemed to confirm it. It is not on the neck alone that accidents of this kind have been observed. M. Piedagnel relates the history of a man from whose shoulder an enormous tumor was extirpated by M. Beauchene, in 1818. The operation had not been completed when the patient exclaimed, *there is blood falling in my heart, I am a dead man!* and he died, in reality. The same happened to M. Clemot after removing a tumor from the breast, and two patients upon whom he opened one of the axillary veins were on the point of meeting the same fate. These observations do not, in my opinion, place the matter beyond all dispute. The late experiments of M. Poiseuille, tend to prove that if the absence of valves in the large veins of the neck renders it possible, it is not so in the extremities and other parts of the body. The patient of Klein, and the adult operated upon in 1830, by M. Dupuytren, for a thyrocele, also died suddenly, and yet there was no thought of referring this occurrence to the passage of air through the veins. Thus, without denying its possibility (at least when the veins, lost as it were in the midst of firm tissues to which their external surface adheres and which they excavate in form of canals, after their division remain patulous at the bottom of the wound), I still think that this phenomenon requires to be confirmed by further observations. The surfaces being well sponged and the threads brought out at the angles of the wound, it remains only to approximate the flaps and to close the wound more or less completely. As in front of the neck the centre of the wound is more elevated than its sides, I see only advantage in attempting immediate union rather by adhesive strips or several stitches, provided, however, that with the exception of the ligatures no foreign body is obliged to be left under the skin. For the rest, the several parts of the dressing should be light, and very softly applied. All compression in this place would be dangerous, and a too great load of apparatus would occasion an injurious degree of warmth. If the tumor includes but one side of the thyroid, or, if independent of that body, it is situated on some other point of

the anterior half of the neck, the modifications to be adopted in the process I have just described, are very trifling, and too easily conceived to render it necessary to give them here at length.

Art. 2.—Air Passages.

§ 1. *Bronchotomy.*

By the term *bronchotomy*, the ancients intended to designate the artificial and methodical opening of the aeriferous canal in its cervical region, and by no means that of the bronchia as its etymology would lead us to infer. At present, as it is performed on different points of the respiratory canal, by the word *bronchotomy* is to be understood the operation in general, while in its special application it includes, *tracheotomy*, *laryngotomy*, and *laryngo-tracheotomy*. Asclepiades of Bithynia was the first, I believe, who ventured to perform it. No one previous to Antyllus and Paulus Egineta, had described it. C. Aurelianus, Aretæus, and most of the Greek authors reject even the idea; on the one hand, because, according to them, a wound of the cartilages is mortal, and on the other, because bronchotomy appeared to them only calculated to increase the inflammation of the trachea. Rhazes advises it only in the case of imminent death; and although, to prove that the divided cartilages can reunite, Albucasis cites the case of a young girl whose throat was cut, and who recovered completely; and for the same purpose Avenzoar made several successful experiments upon goats, it is yet necessary to come down to 1529 and 1543, to see it repeated by A. Benivieni and M. Brassavole. Only since the time of Fabricius ab Aquapendente, have writers in general admitted its utility, and even necessity, under some circumstances. And they have not always agreed upon the cases which require it.

Indications and Appreciation.—P. d'Abano, who called it *subscannation*, and after him Gherli of Modena, G. Martini, &c., thought it indicated in every case of *angina tonsillaris* or *laryngea*, which threatened suffocation; but although defended by Mead and Louis, their opinion, which by the way is as old as the days of Avicenna, and was strenuously opposed by Cheyne, is scarcely admitted any longer, but by Drs. Baillie and Fare. Purely inflammatory angina, however intense it may be, rarely goes so far as to require such a relief; medicine possesses means to oppose it not less efficacious and much less fearful. It can scarcely be comprehended how acute swelling of the tonsils, for which Flajani did not fear to have recourse to it, can ever require it. The same with greater reason applies to their chronic engorgement, which with much less danger is always to be removed by excision. When the tongue suddenly swells so as to fill the mouth and close the isthmus of the fauces, Richter and B. Bell, who recommended it, certainly forgot that two or three deep incisions on the dorsum of the affected organ would cause its diminution, and probably they were not acquainted with the observations of Delamalle on this subject. I can hardly believe that it was not possible to dispense with it in the case in which Mr. Burgess lately performed it; since there was but an inflammatory intumescence, produced by a burn, at the bottom of the buccal cavity. Moreover, it is almost universally admitted, since Desault, that it is not proper in the consequences

of submersion, and that in prescribing it in asphyxia of drowned persons, Detharding was entirely mistaken as to the manner in which death is caused under such circumstances. Nevertheless, Mr. S. Cooper, who considers it more prompt and easy than the introduction of a gum-elastic sound through the nose or mouth, is right in my opinion in maintaining that it should not be proscribed without restriction. If the mouth is firmly closed, if the sound does not strike the opening of the larynx, bronchotomy is better than nothing, since prompt action is necessary, and air must be made to enter the lungs. When we reflect on the difficulty of closing the glottis entirely with the tube which we engage in it, and of preventing the insufflated air from escaping by the digestive passages, in every case in which the surgeon thinks proper to attempt artificial respiration, we must feel disposed to accord this operation over the use of the catheter.

Œdematous Angina, that is serous enlargement of the lips of the glottis, is a disease of which bronchotomy seems to constitute the remedy *par excellence*. By supplying a passage for the respiration, it affords the physician time to attack the disease by appropriate means, and to the organism the means of extinguishing it, or at least of resisting its further advances. The antagonists of Bayle, the first who speaks of it on this occasion, reject it under a pretext which to me does not seem valid. Their permanent tube in the natural passages, could not be left in the trachea for from eight to fifteen days without danger; while a canula, once inserted through an artificial opening in the air canal, gives but little inconvenience. I think therefore, with Mr. Lawrence, that in this species of disease, otherwise almost constantly fatal, it deserves some attention, and offers a much better chance of success than scarifications of the infiltrated parts, which have been proposed by some practitioners. The patient, whose case is given by M. Roullois, of Mayenne in his thesis, and who was operated upon at the hospital Saint Antoine, by M. Kapeler, in 1828, died, it is true, at the expiration of thirty-six hours, but after having been recalled as by a miracle from death to life, and very probably because the air could not be made to pass in sufficient quantity and without interruption into the lungs. The subject mentioned in the supplementary journal was more fortunate: he survived. A polypus, a tumor in the nasal fossæ or pharynx, the thyroid body or some lymphatic ganglia, swelled, indurated, and large enough to prevent the passage of the air through the trachea, do not render the operation indispensable except when there is imminent danger of suffocation, or when it is impossible or too dangerous to attempt the removal of the morbid mass. Sharp reserved it in some measure for these cases alone; for it did not appear to him absolutely necessary in the extraction of foreign bodies.

Foreign Bodies.—At present it is chiefly to reach heterogeneous substances of some consistence, which are often introduced into the larynx or trachea, that this operation is willingly performed. It is used in this way for the extraction of clots of blood which have fallen from the mouth or from a wound of the larynx; lumbrici; flies; portions of food, such as fish bones, bones of poultry; fragments of mushrooms, of apples, of chesnuts, or of acorns; polypus of the pharnyx; a cherry, prune, or apricot stones; a French bean, a grape-seed, a pill, a filbert, a piece of gold, a piece of silver, flocks of wool or tow, a bullet, a button mould, a pebble, a pin, a needle; fibrous tumors, probably

syphilitic, such as M. Senn has recently described, developed in the interior of the pharynx; a piece of cartilage, of tendon, of wood, of iron, of membraniform concretion; in a word, of every body which in any way may be lodged in the glottis or the trachea. When the presence of one of these bodies in the respiratory passages is duly ascertained, in case it cannot be seized through the mouth by the fingers or forceps, there is no question of the advantages of bronchotomy. In the case published by M. d'Arcy, although the accident had occurred but a few hours before, the bean had already become trebled in size. Although the primitive symptoms which the foreign body has occasioned are partially calmed, it does not cease to be the less positively indicated. In fact the monk mentioned in the *Eph. des cur. de la nat.*, and who did not dare to complain at first, did not die phthysical until the expiration of two years. One of the patients cited by Louis, was so well that he was regarded as almost cured; yet he sunk at the end of the third week. Another who lived several years with a louis d'or in the bronchia, died at last in consequence of its presence. Tulpius, V. D. Wiel, Bartholin, Pelletan, and M. Dupuytren, have also seen in some cases, the foreign body permitting respiration to resume in some degree its original ease, and causing death after the lapse of one or several months; and even years. There are also some, which, after this lapse of time have been spontaneously expelled: witness the rump of the fowl mentioned by Sue. But these happy efforts of the organism so rarely occur, that it would be imprudent to reckon on them, and bronchotomy should never be dispensed with under such insufficient pretexts. Foreign bodies lodged in the œsophagus, inflammatory swellings sometimes caused by wounds, injuries of the neck, have also induced some practitioners to perform bronchotomy to prevent suffocation and give time to subdue the principal disease. Habicot immediately subjected a lad to it, who, in returning from a fair, had no other resource to escape robbers than to swallow all the gold he had with him, rolled into a pacquet. In the same manner he successfully treated a patient, who, covered with wounds, was on the point of perishing for want of the power of respiration. We should evidently do the same when life is seriously threatened by the presence of heterogeneous masses in the œsophagus, or the swelling of the lips of a wound in the larynx, when it is not possible immediately to remove in any other manner the cause of suffocation.

Croup or laryngeal and tracheal *diphtheritis*, that horrible disease, the nature and treatment of which have been made equally clear by the excellent researches of M. Bretonneau, is one of those affections which it seems at first may be opposed with the greatest advantage by bronchotomy. Yet, notwithstanding the assertions of M. A. Severin, Bartholin, and some other practitioners of the seventeenth and eighteenth century, who are said to have employed it with the best results, the physicians of our day still doubted, in 1825, that in the existence of the disease it was of great importance, and that science had more than conclusive and authentic example of cure that could reasonably be attributed to it. Those given by Mr. S. Cooper, in his own name, or that of Mr. Lawrence, or M. Chevallier, by no means prove that these surgeons observed the real croup. The case reported in the name of Dr. Andree, by Bursieri, Locatelli, Michælis, and White, is the only one accompanied with details sufficiently circumstantial to partially satisfy the mind. The view in which bronchotomy has been considered until

the present day, does not permit us to draw much advantage from it in croup. Indeed it is not understood how it can remedy inflammation or spasm of the larynx, which, according to Royer-Colard, &c., in this disease bring on the fatal termination, or pulmonary engorgement, any more than the reproduction of the morbid product, which by this means is removed from the trachea without influencing in the least its extension in the bronchia. In this particular, Dr. Carron has certainly exaggerated its importance, while MM. Desrulles, Bland, &c., are right in contesting its utility. But it is not to be considered in this point of view. Subjects affected with diphtheritis die in a state of asphyxia for want of the power of respiration. The asphyxia is constantly caused by the presence of a false membrane, or swelling of the laryngeal membrane, and never depends on a spasmodic affection, which the cartilaginous texture renders impossible or insignificant in the large bronchia, the trachia, and the larynx. Now, we are to resort to bronchotomy less for the purpose of extracting membraniform concretions, than for gaining time and placing the patient in a condition to breathe while means of cure are devised. M. Bretonneau has proved, moreover, that after the trachea has been opened, calomel may be pushed through with advantage, or even a solution of the nitrate of silver may be carried down by a small sponge on the end of a slip of whalebone, and the false membrane, followed even into the bronchia and diphtheritis of the trachea, treated as he has done with so much success that of the throat. In this view bronchotomy is a precious resource which should be employed whenever the disease, occurring in the larynx or below it, cannot be reached through the mouth with topical remedies, but which, however, has not yet passed below the first bronchial divisions. Four unexpected cures are adduced in support of this doctrine. In the month of July, 1825, M. Bretonneau being called to see Mademoiselle de Puysegur, a child four years old, whose three brothers had died of croup andwho was herself affected to the last degree, opened the trachea freely and introduced a canula through the wound; false membranes escaped in great number for several days; he blew in calomel in powder, which was not borne well; afterwards the same substance mingled with water; and thus succeeded in saving this unfortunate child. In a boy, seven or eight years old, whom I examined at Tours, in 1827, a month after his cure, and who in the most advanced stage of the disorder had been given up for dead by his parents, M. Bretonneau opened the trachea as before, and saw life return at the expiration of several minutes; he extracted numerous membraniform concretions, and felt obliged a little later to introduce through a canula which he kept in the wound, a solution of lunar caustic, by means of a small piece of sponge fixed on the end of a slender bit of whalebone, and after various obstacles, which were overcome as soon as perceived, the child was entirely restored. Quite recently (October, 1831) the same practitioner was no less successful with a third patient. The child, eleven years old, was looked upon as dead, when M. Bretonneau was called to him. He opened the trachea immediately, and after several casualties, which were met by the best conceived means, the young patient was completely cured.

A similar success has just been obtained at Paris, by M. Trousseau. A boy of six years and a half, was seized on the 21st November, 1831, with a violent sore throat, attended with cough, hoarseness, and some fever. On the 23d, at nine o'clock at night, three physicians met in consultation. They were

all of opinion that the child was affected with croup, and that death would infallibly take place before two hours. M. Trousseau proposed tracheotomy, and performed it on the spot. The trachea was opened, beginning from the cricoid cartilage, to the extent of seven lines. Hemorrhage from the veins ceased almost immediately. However, a considerable quantity of blood fell into the bronchia, which the child immediately threw out by the wound, together with fragments of false membrane. Respiration immediately became perfectly easy. A flat canula, was then introduced, similar to the one described by M. Bretonneau in his treatise on diphtheritis; then twenty drops of a solution of nitrate of silver were dropped into the bronchia (ʒj for ℥j of water). This instillation was repeated every six hours for three days and a half. Every hour twenty drops of tepid infusion of mallows was thrown in. It was not until the fourth day of the operation that the child ceased to throw up diphtheritic concretions. The canula was withdrawn and cleansed three times a day. While in the wound it was cleared several times every hour by means of a small mop of horse-hair. On the tenth day the air began to pass freely through the larynx; and on the twenty-fifth the wound of the integuments was completely cicatrized. At present (January 1832) the child enjoys excellent health.

Other diseases in my opinion are susceptible of being advantageously modified by bronchotomy. *Phthysis laryngea* for instance, and those chronic phlegmasiæ which eventually produce a certain diminution of the glottis. The air finding a free passage beneath, leaves the larynx at rest, and offers no obstacle to the healing efforts of the organism. Besides, we thus have a new passage through which topical remedies may come in immediate contact with the disease. Horses affected with the hives, have also the glottis diminished, and present to the observer experiments altogether in favor of what I have just advanced. Two of these animals employed in a manufactory of red lead at Tours, recovered their ordinary state of health after a large canula had been fixed in the trachea. M. Barthelemy, and other veterinary surgeons have given cases much similar. Applied to man, these data have not deceived the expectations of practitioners. M. Clouet of Verdun, instructed a woman, whom a fistula in the larynx and other disorders had rendered liable to suffocation, to wear a similar canula for twelve years. Price, of Plymouth, owed ten years of flourishing health to the same kind of assistance. In 1824, M. Bulliard, restored to existence a young soldier whom a chronic laryngitis, and not the croup as he supposed, had borne to the gates of death, after several fits of suffocation, by placing in the larynx a canula which the patient wore for fifteen months. M. Godeve was no less fortunate with a patient affected, as he says, with an ulcer of the larynx, but rather as I think with a swelling of the vocal chords, who discontinued the use of the canula without inconvenience at the end of six months. A patient of Mr. White wore one for two years. M. Senn of Geneva, mentions the case of a child, ten or twelve years old, who was threatened every instant with imminent suffocation, in consequence of frequently repeated inflammations, and was cured as by a miracle by means of laryngotomy and a canula, which was not laid by until the expiration of eleven months. It was much the same with two patients operated on by M. Regnoli, who had a real coarctation of the larynx.

In a word, bronchotomy is an operation to be tried always, or almost always,

when a mechanical obstacle, from whatever part it come, tends to produce asphyxia, by diminishing more or less the calibre of the respiratory tube. It is really very little dangerous in its nature. If up to the present day it has not been more frequently practised, it was for want of a correct view of its mode of action in cases other than those of foreign bodies, of reflecting that to re-establish respiration it was sufficient to open any kind of passage to the air, and of perceiving that if the artificial opening is sensibly less than the natural passages, the lungs remain incapable of performing their functions completely, and in this case the operation in a great measure fails of its intention. On this point there is a truth placed beyond doubt by M. Bretonneau, and likely to be attended with the most happy practical consequences. In the case of one of the horses just mentioned the tracheal canula was only six lines in diameter. When the animal became a little fatigued it was panting and out of breath. A canula of an inch was substituted for the first, and the horse immediately breathed freely and was able to bear the most violent exertions. In the little patients whom the practitioner of Tours cured by bronchotomy, was the canula of itself too small, or was its diameter diminished by concretions and mucosities? If the symptoms of asphyxia disappeared for a moment, we see that they quickly returned. On the contrary, when it was cleared out or made larger the child seemed to revive. The same peculiarities are found in the observations of Messrs. Bulliard, Senn, and Trousseau. Mr. W. Cullen, who omits to credit this idea to M. Bretonneau, collected in 1827 other facts no less conclusive to support it, and render it prevalent in England. After all, on this point every one may make himself a subject of experiment. Diminish for example the size of the atmospheric column which naturally goes to the lungs, take from the opening of the nose one-half or two-thirds of their dimensions, by closing them with a quill or gum-elastic tube; respiration will not be arrested, but it will soon become painful, and in proportion to the narrowing of the passage. It is of importance, therefore, in having recourse to bronchotomy for the purpose of maintaining respiration beyond several minutes, to open the air tube freely, and to leave in the wound a canula of sufficient diameter. This leads us to inquire which is best, tracheotomy, laryngotomy, or laryngo-tracheotomy. The ancients had not to discuss this question. They had only to do with the opening of the trachea. That of the cricothyroid membrane was not employed until Vicq d'Azyr, who proposed it before the end of the last century. Desault is the first who conceived the idea of completely dividing the thyroid cartilage on the median line; and to M. Boyer belongs that of incising at once from above downwards the encoid cartilage and the first rings of the trachea.

A. *Anatomical and Surgical Remarks.*—1. *Larynx.* Formed of solid cartilages, of muscles tense as chords, and of a membrane pliant as well as vascular, the larynx is beyond the danger of all spasmodic contraction capable of diminishing its dimensions with any degree of permanence. But on the other hand the accumulation of fluids in its internal membrane, the least turgescence soon diminishes all its diameters, so as to endanger life. The larynx is free posteriorly, where it forms part of the anterior wall of the pharynx; covered in front only by the skin and aponeurosis, on its sides by the sterno-hyoid and thyro-hyoid muscles, accompanied laterally by the trunks of the

carotids; separated from the os hyoides by a furrow, at the bottom of which is found the thyro-hyoid membrane, which is pierced laterally by the superior laryngeal nerve and an arterial branch. It presents on the median line the prominence of the principal cartilage much more apparent in man than in woman, and in adult age than in childhood; and has lower down a slight depression corresponding to the crico-thyroid membrane, which is crossed by the artery of the same name, sometimes a little higher sometimes lower; with another small prominence owing to the presence of the cricoid cartilage, below which is found the thyroid mass, and the anterior face of which is often covered with an arteriole, single or double, which descends vertically from the cricoid arch towards the thyroid body. When it preserves its natural proportions, it is much larger in the adult man than in individuals of different sex or age (hence the dangers induced by inflammations before the age of puberty), and receives behind and on its sides the termination of the recurrent nerve.

Laryngotomy after the manner of Vicq d'Azyr, adopted at present by a great number of surgeons, offers the undoubted advantage of being easier of performance, of acting only on a membrane scarcely organized and very superficially situated, of not exposing any vessel or any important part to be wounded, and of leaving the glottis untouched; but on the one part it does not produce an opening sufficiently large to allow passage to the instruments required for the extraction of foreign bodies; and on the other, the canula which can be thus employed will rarely be large enough to admit a sufficient quantity of air. By imitating Desault, on the contrary, as has been done in America and in England, as also by Mr. Whately, by an incision from above downwards, and M. Blandin in 1829, no risk is run of dividing a vein or artery of any size. It is the only means of bringing in some measure into view foreign bodies which lodge or are arrested between the lips of the glottis, polypi, or other vegetations, which, as well as worms, may be found at this part of the organ. However, although lesion of the vocal chords, so much dreaded by those opposed to Desault, is easy to be avoided, and moreover is but of minor importance, although the voice of patients treated by this method has not suffered more than by every other, yet it only deserves preference in the cases just pointed out; besides, the patient should not be of an age to have the thyroid cartilage too much charged with phosphate of lime. If the fear of wounding the vocal chords be an obstacle, the surgeon may follow the advice of M. Fouilhoux, and divide the thyroid cartilage on the side, and then open the soft parts of the glottis transversely to avoid it. When the foreign body is below the larynx, or when the intention is to place a tube in the wound, it is evident that this process is not the proper one; perhaps it would be possible always to supply it by another operation lately proposed by M. Vidal, of Cassis, for opening abscess of the glottis, and by M. Malgaine; an operation, the idea of which no doubt arose from the experiments of Bichat on the voice, and which consists in penetrating through the thyroid membrane, and even the epiglottis, if it be too difficult to reflect it forwards through the wound. However, this operation has something repugnant in it, at least at first sight, which induces me to say nothing further of it, although I have succeeded very well in experiments on the dead body.

Laryngo-tracheotomy, which usually leaves the thyroid body entire, and exposes only the crico-thyroid artery to be cut, does not, like Desault's method, permit us to see to the bottom of the larynx, and acts upon a point too distant from the bronchia for foreign bodies not very movable to be easily brought to the opening, and too near the glottis not to render the use of a perpetual canula very dangerous; so that, notwithstanding its inconveniences, tracheotomy seems to me to unite more advantages under all circumstances in which the process of Desault is not positively required.

2d. *Trachea.*—The trachea, a kind of cylindrical canal, which descends to a level with the second or third dorsal vertebra, formed of a score of cartilaginous rings completed at their posterior fifth by a fibro-muscular membrane, rests upon the œsophagus, inclining a little more to the right than to the left, and is covered first by the common integuments, secondly by the cervical fascia, single above, bifoliated below, where adipose masses and vascular tissue, and then the sternum, separate it into two laminæ; thirdly, by the isthmus of the thyroid body near the cricoid cartilage; lower down by the supra-sternal venous plexus, lymphatic ganglia, common tissue, and the middle thyroid artery when it exists; fourthly, by a last fibro-cellular layer, which is sometimes wanting; and fifthly, by the sterno-hyoid and sterno-thyroid muscles placed a little laterally. Behind the inferior laryngeal nerve, and at some distance further, the primitive carotids run along it, and it is sometimes crossed by one of the thyroid arteries, which in that case runs from one side of the neck to the other. In children, particularly, the arteria innominata covers nearly always its anterior face until beyond the limits of the thorax, so that the right carotid leaves it very high up to take its place quite on the side, and it would be easy to wound either in performing tracheotomy, if this disposition were forgotten. I have also seen the left carotid rise on the right, and pass in front of the trachea to reach its ordinary destination, and reciprocally that of the right side. Other vascular anomalies have also been met with in this region, and merit no less attention than the preceding. From all these considerations, it results that the trachea, though quite superficial above where the thyroid body, which protects its lateral parts almost solely separates it from the integuments, becomes deeper in proportion as we descend or incline towards the chest, following the thoracic concavity of the spine, and at the inferior part of the neck it must be sought for at an inch below the skin. The cartilaginous rings which compose it should be sufficient of themselves to banish the idea of spasmodic contractions, which have been so gratuitously attributed to it in croup. The membranous and almost fleshy structure of its posterior portion, which rests on the œsophagus and partially embraces it, explains how foreign bodies, lodged in the canal of deglutition, have sufficed to cause suffocation, or pass into its interior and render bronchotomy necessary. To conclude, the great mobility it enjoys, if care be not taken in attempting to open it, causes it to be very easily pushed aside, so much that the instrument strikes on the primitive carotid, as happened in a case mentioned by Desault, in which a student of medicine in asphyxia was thus destroyed by one of his companions in an attempt to save him.

Examination of the Methods.—Those authors, who in ancient times recommended bronchotomy, confined themselves, like Antyllus, to a transverse

division in the middle of the neck, of the integuments and the space between the third and fourth rings of the trachea. J. Fabricius was the first to propose the performance of the operations by two separate stages; first, to incise the soft parts from above downwards on the median line, and then to open the windpipe, as practised by the ancients. He left in the wound a straight canula furnished with wings. Casserius slightly curved his canula, which, according to Solingen, should be flattened; its external opening Moreau covered with a sindon, and Garengeot with a piece of muslin, to prevent foreign bodies from entering the trachea. To prevent its obliteration, and the necessity of removing it for the purpose of cleaning it, G. Martine found it useful to employ two, one within the other. Ficker, who adopts the idea of Martine, requires the external canula to be of silver, the internal one of gumelastic, and that both should have a certain degree of curvature; in fine, some moderns have maintained, with Ferrein, that the barrel of a quill may advantageously supply its place. The manner of introducing this canula and fixing it has not been less various than its form. Sanctorius inserted it with a trocar, and Dekkers carried it into the trachea, dividing the skin also with the same instrument. Moreau made a passage for it between two rings with a simple lancet, and Dionis carried it in upon a stylet. That of Bauchot is very short, flat; and its inventor, who used besides a kind of crescent mounted on a handle for fixing the larynx, had, like Dekkers and Sanctorius, a stylet of the same form, sharp at its extremity, to pass through the skin and enter at once the trachea. Richter bent Bauchot's instrument into a circular arch for the purpose of rendering it more tolerable; and maintains that by the wound of the trachea being immediately filled by the canula, hemorrhage is much less likely to occur than in previous incision of the tissues. But this is an error, and notwithstanding what has been said of it by Bergier and B. Bell, all these modes of entering this passage with a single stroke are at present generally and justly proscribed.

The dread of wounding the cartilaginous arches, revived by Purmann, no longer exists. Heister has satisfactorily demonstrated that they may be divided without the least risk. Virgili, of Cadiz, was obliged to divide them as far as the sixth in a soldier, to rescue him from the danger of suffocation, which the ordinary incision was about producing by determining a flow of blood into the trachea. Instead of a canula he kept in the wound a plate of lead bent on its edges and perforated with holes. To extract the half of an acorn Wendt did not hesitate to cut through three of the cartilages; and Percy advises on this head to use scissors instead of the bistoury, which, however, is much more convenient, and preferred with reason by almost every practitioner. My own opinion on these different modes of proceeding has no doubt been already guessed. In the first place I would banish all transverse incisions. In the case of a foreign body the division of the space between two cartilages cannot be sufficient; and if the operation is to restore the power of respiration, such a wound will never be large enough. If further proof be necessary, a subject recently operated on in a large hospital will furnish it. The opening of the trachea had been well made, the canula was properly placed, but it was a portion of a gumelastic catheter, and the patient being obliged to take in air by so small an orifice was only half delivered from the suffocation for which bronchotomy was performed. In the first case canulæ and perforated plates

are useless. When the trachea is free the wound is to be united or permitted to close. If the foreign body is movable the air from the lungs may force it out. If it do not spontaneously present at the wound it is to be sought for with slender curved forceps, or some other appropriate instrument, in the direction of the bronchia. When it is not possible to reach it or meet with it, it is to be left, the wound kept open, and the patient watched. The next day, or the one succeeding, it will generally be found on the lower surface of the apparatus. Desault, Pelletan, and M. Dupuytren, have seen escape thus a fruit stone, a bean, a piece of money, &c.; and the needle which M. Blandin could not succeed in seizing, after cutting the thyroid cartilage, also came away in this manner. In the second, the canula is indispensable; but as no author had made known the importance of a large and permanent opening, none of the tubes which have been proposed are proper for it. That of M. Bulliard is cylindrical, long, and very curved. M. Bretonneau has successively formed them of different shapes. The canula he used in the case of Mmslle. de Puysegur was double like that of Martine, flat, a little concave on its inferior edge, and four lines broad in its greatest diameter. The one he employed in the patient whom I saw, was formed of two parts, one superior the other inferior, which he placed separately in the wound, and which being united represented an instrument similar to the preceding. Two languets, in the form of a finger nail, which come off above and below at nearly a right angle, fixed it very firmly in the trachea, and permitted a circular fold of linen, pierced in the centre, to be placed between its exterior end and the integuments of the neck, and which could be opened or closed at pleasure by means of a kind of hinge. This piece of linen fulfills two important indications; by closing it with more or less force it compresses the backs of the two gutters, which by their union form the canula, forces them to close within each other, and in this manner reduces to any desirable degree the diameter of the artificial tube. According to the thickness given to it, it lengthens or shortens the canula, and keeps its inner extremity exactly applied against the internal face of the organ, prevents it from wounding the interior of this canal, and makes the same tube answer for patients, the thickness of the walls of whose necks may be very different. When in its place, if it is desirable to enlarge it, or when any foreign body tends to obliterate it, we have only to pass into it another canula larger, but not jointed, which is withdrawn and reintroduced without deranging any thing else.

Whether a canula is to be used or not, some persons have proposed not only section of the cartilages of the trachea, but also to cut out and remove a portion of the anterior wall of the canal. It appears that veterinary surgeons have often done so. Dr. Andree seems also to have followed this process, which is formally recommended by Mr. Lawrence, Mr. Porter, &c. But it is a precaution at once unnecessary and dangerous: unnecessary, as pure and simple incision always permits the introduction of an artificial tube; and dangerous, because if it should become advantageous to close it, there will result as a necessary consequence an incurable contraction of the diameter of the respiratory canal. Consequently, the process of M. Colineau to effect this loss of substance, and at the same time render all kinds of hemorrhage impossible—a process which consists in piercing the trachea by means of a sharp plate projecting from the circumference of a flat disk of copper heated

to whiteness, fastened on a long handle—has not in my opinion any useful purpose, and should be left unapplied. The advice of Messrs. Carmichael and White is directed to the same end.

Manual.—The apparatus consists of a straight or convex bistoury, a probe-pointed bistoury, one or more canulas supplied with ribands and every thing necessary to fix them, a forceps with rings, and a polypus forceps very slender, several single ligatures and needles, hooks or probes bent into crotchets, and various pieces of dressing. The patient is to be laid on his back, and to have his head moderately bent back. Verduc has well explained, that by having the head bent far backwards respiration is rendered more difficult, a remark which applies to all the modes of performing bronchotomy. Placed on the right, in order to cut from above downwards, and not from below upwards, as directed by some, the surgeon takes hold of and fixes the larynx with the left hand, while with the right, using a straight or convex bistoury, he divides the tissues.

1. *Tracheotomy.*—In order that tracheotomy should be well performed, it is necessary that the wound of the soft parts extend from the isthmus of the thyroid, that is, from the boundary of the cricoid cartilage until quite near the sternum. Beneath the integuments and fascia are the blood vessels, which are to be tied as soon as divided; the veins of the thyroid plexus, which are also to be tied when it is not possible to avoid them; and the middle inferior thyroid artery, when it exists, which it would be dangerous to wound. Arrived in front of the trachea, if the venous blood flows abundantly and there is no urgency, we may suspend the operation from twelve to twenty-four hours, after the example of M. Recamier, and some others; or at least wait some minutes for respiration to cause the hemorrhage to cease: but if the case is urgent we are to pass ligatures round the bleeding vessels, or even proceed to open the air canal itself. Although the straight bistoury held as a writing pen is sufficient to effect this opening, which should include at least the fourth, fifth, and sixth, if not the seventh and third cartilaginous rings, yet there are practitioners who prefer the probe-pointed bistoury to continue it after the puncture. In this I see no advantage or disadvantage: should even the point of the instrument touch the posterior wall of the respiratory tube, which appears to be the cause of dread, there probably would not result much danger. This part of the operation being over, a different course is to be pursued, according as the intention is to extract a foreign body, or to relieve suffocation caused by a lesion of the pharynx. In the first case, if the body is not immediately expelled by the efforts of the patient, but presents at the wound, the operator is gently to separate the lips of the wound with the forceps or hooks, and endeavor to extract it with an appropriate instrument. When it is fixed in the direction of the bronchia, which, as Favier has shown, is rather rare, there is carried with all possible precaution in this direction a proper forceps, or rather a small curette, to hook or grasp it. If these attempts prove fruitless they should not be too often repeated. A number of cases are given, in which foreign bodies, which no attempt could discover, afterwards came away of themselves, and have been found among the dressings. If the intention of the surgeon is only to establish artificial respiration he immediately inserts the canula, taking its inferior half, if he uses Bretonneau's, and carrying it into the trachea, while with a peculiar kind of forceps, with beaks very flat

and bent into the shape of a Z on their inferior edge, he opens the wound; he then fixes the other half, and applies the linen shield between the shoulder of the instrument and the neck; lines its interior with the other canula prepared for the purpose; carries the two ribands attached to its extremity to the nape of the neck; brings them back above it to make a second turn, and ties them below it in a bow-knot. If during the operation venous hemorrhage should be too abundant, and resist ordinary means, we should not be frightened and quit the patient, as was done by Ferrand in a similar case. If the patient enjoys his reason he should be soothed, and made to breathe as freely as possible, and the blood will soon stop of itself. If it escape into the trachea, and give rise to unfavorable symptoms, it will be a further motive to imitate Virgili in opening largely and unhesitatingly the respiratory tube. We may also, like M. Roux, if danger is pressing, place the mouth over the wound and suck out the fluids which threaten suffocation.

2. *Thyroid Laryngotomy.*—When the larynx is to be opened, the incision should commence at the projecting angle of the thyroid cartilage, and descend a little below the cricoid; not requiring to be as long as for tracheotomy. The surgeon cuts successively through the skin the subcutaneous layer and the facia; separates the thyroid muscles; carries the end of the forefinger upon the crico-thyroid membrane, endeavors to feel the artery of the same name; raises or depresses it with the nail, according as he intends cutting above or below; plunges his straight bistoury perpendicularly into the membrane, guiding it on the finger nail, turning its edge upwards or downwards, according to the side to which the arterial arch may have been pushed, and there makes an opening of proper dimensions.

3. *Laryngo-tracheotomy.*—To transform the preceding operation into laryngo-tracheotomy we have only to use a probe-pointed bistoury instead of the straight, and to enlarge the wound from above downwards by dividing the cricoid cartilage and the first rings of the trachea on the median line. The same instrument carried from below upwards, may also serve very well for separating the two halves of the thyroid cartilage according to the plan of Desault. Supposing that in spite of every precaution the crico-thyroid artery be cut, and it should chance to prove the cause of a harrassing hemorrhage, it may be easily tied on the right and on the left; and I am astonished that a vessel of such little importance should have caused so much anxiety. The little finger introduced in the wound first seeks for the foreign body, and then serves as a conductor to the forceps or any other instrument that it may be necessary to employ. When that is removed the wound is immediately to be closed, and the cure is in general very speedy. When, on the contrary, it cannot be found, the wound is left open and treated as in tracheotomy. I do not think that the suture advised by some authors and practised by Herold should ever be used, notwithstanding the opinions of MM. Delpech and Serre. The patient mentioned by Wilmer, who had been thus treated, died suddenly on the fifth day of the operation. It is only proper in this case to solicit the flow of blood or other fluids, either between the air tube and tissues which surround it or the interior of the canal itself, and the other retentive means are always sufficient for the union of a wound like this.

4. *Thyro-hyoid Laryngotomy.*—After laying bare the thyro-hyoid membrane on the median line, by an incision of two inches in extent, it is less diffi-

cult than may be imagined to reach the superior vocal chords, by dividing it transversely above and a little behind the cartilage to which it is attached. A bistoury, entered at this point from above downwards and from before backwards, traverses the root of the epiglottis and immediately falls into the larynx, the finger or forceps clearing a way, which may be enlarged at pleasure, and which allows a full examination of the glottis without deranging either the vocal chords or the cartilages. No artery of any size, and no important nerve can be wounded. The laryngeal branch of the superior thyroid and the corresponding nerve, are at a sufficient distance from the median line to be easily avoided, and no venous plexus is to be found at this point. The wound which results will have some tendency to remain open, but it is probable that in the living subject inflammation will soon approximate its edges, and cicatrization take place without difficulty. Let me add, that if bronchotomy often fails of success it is because the operation is too long deferred, that it is rarely decided upon before pulmonary engorgement has rendered the preservation of life almost impossible, and that in reality there is very little danger in the operation. When it is performed for croup, and to permit remedies to be dropped into the trachea, the consecutive treatment forms its capital point. On this point I can but refer to the Treatise of M. Bretonneau and the observation of M. Trousseau.

§ 2. *Bronchoplasm.*

If it happen that after wearing a canula a long time in the week, or that in consequence of any wound whatever the patient retain a fistulous opening to the air passages, he may be subjected to the treatment of fistula in general, and if nothing else will succeed it will be allowable, as M. Dupuytren has once done, to resort to the process of cheiloplasm, and particularly that of M. Roux. A cutaneous flap turned back from below upwards, rolled as a stopper and fixed in the fistula by two stitches, in a patient upon whom I have just operated, is another resource which in my opinion ought not to be disregarded.

§ 3. *Catheterism.*

In new born infants, or at any other period of life, catheterism of the larynx is an operation too simple to require a longer description. While one hand conducts the instrument through the nose, or rather through the mouth, one or two fingers of the other carried into the fauces, take hold of its extremity, direct it into the glottis, and prevent its going towards the œsophagus.

Art. 3.—*Alimentary Passages.*

§ 1. *Catheterism.*

Various affections render necessary the introduction of a sound or catheter into the œsophagus. It is used as an exploring, extracting, or repelling means, as will be shown when we come to speak of foreign bodies; it is an indispensable operation for entering the stomach, or when food or remedial sub-

stances are to be artificially introduced, and lastly, it may be employed in the treatment of certain diseases of the œsophagus itself. The performance is easy and in the power of every one. It may be effected through the nose as well as the mouth, with metallic instruments of proper curvature, and particularly with flexible bodies; such as canulæ of gumelastic, bougies, whalebone, rods &c.

By the Nose.—The first method, that of passing through the nasal fossæ, for a long time adopted as the best, at present is almost generally abandoned. It is often difficult and fatiguing to the patient, and should only be retained as an exceptional method. If the catheter is stiff, its curve scarcely allows it to go further than the summit of the pharyngeal cavity, and consequently hardly permits it to enter the œsophagus; if straight and flexible, it impinges against the spinal wall of the back part of the mouth, so as to be not always easily disengaged. This way is better than none, however, if the other be not practicable. The sound held in the right hand as a pen, is carried through the nostril in the same manner and with the same precaution as for catheterism of the Eustachian tube, except, that instead of being turned outwards or inwards, the concavity of its beak ought rather to look downwards. By means of the index finger, or a blunt hook passed into the mouth, the operator reaches its extremity as soon as it arrives at the upper part of the pharynx, depresses it a little with the left hand, while with the right he continues to push it forward; he thus directs its point in the axis of the œsophagus, avoiding with care the entrance of the larynx, and rubbing too hard against the parieties of the organ; advances gradually, stops at the least difficulty; changes a little the direction of his efforts, withdraws the instrument in some degree to push it in another direction if he meet any resistance; and descends to a greater or less depth, according to the indication to be fulfilled. Supposing a straight gumelastic tube cause some embarrassment, nothing will be easier than to overcome this difficulty; it is to be carried until on a level with the glottis, by means of a bent stylet it is then to be withdrawn from the sound, and the process is then to be conducted as above.

Through the Mouth.—Whatever be the mode adopted, the patient is to be seated on a chair and held as in all operations on the face. When he penetrates by the mouth, the surgeon depresses the tongue moderately with the left index finger, which he carries, if he can, as far as the epiglottis, so as to keep it as a guard against the deviations of the instrument on the side of the respiratory passages; glides the sound or catheter along the radial edge of this finger, following the dorsal face of the tongue; enters without difficulty the œsophagus if it has the least curvature; hooks the extremity in the contrary case with the directing finger to oblige it to follow the axis of the canal, and at length carries it as far as he judges proper. When circumstances require it to be left in place after the operation, it is inclined to one side and laid in any vacancy which may have been left by the extraction of teeth and fixes it at one of the labial commissures by means of a riband carried round the head. Although introduced by the mouth, if its presence is likely to fatigue this cavity too much, nothing prevents, as judiciously remarked by M. Boyer, the external part from being brought through the nose. For this purpose, after being placed, it will be sufficient to attach it to Bellog's, or any flexible sound introduced through the nostril, and draw it by means of a thread previously

fixed to its extremity, as in plugging of the nasal fossæ. Unless the œsop agus be devious, contracted, or deformed, the operation is ordinarily very simple. There is no risk of injuring its parietes, of taking a wrong direction, or of piercing it, as happened to the surgeon mentioned by Charles Bell, unless we act with extreme imprudence, or a force that no experienced man would attempt to exert. The finger being used for following the sound beyond the epiglottis, it cannot be very difficult to know if by chance it has descended into the larynx, as seems to have been the case in the patient mentioned by M. Worbe. A lighted taper presented to the orifice of the instrument, the almost impossibility of penetrating further than the bronchia, or still better the injection of a few drops of liquid, which would not fail to produce cough, &c., would soon afford a certainty on this point.

The presence of a foreign body in the œsophagus is not borne by all subjects with indifference. In some it produces inclination to vomit, irritation, and sometimes even fever. When more serious symptoms arise, whatever may be its utility, it is to be withdrawn, and replaced some time afterwards if requisite. One of its most formidable disadvantages, although authors have scarcely noticed it, is, that either by its beak, or by the convexity which it is forced to assume, it exercises greater pressure necessarily on some points of the posterior wall of the organic tube than upon others. This pressure, slight as it may appear, being uninterrupted, is of a nature to produce at first a purulent discharge, then ulceration or an eschar, and finally a perforation. The possibility of such an occurrence it is difficult to call in question, when we know that the tip of a simple gumelastic sound has determined them more than once upon the rectal side of the bulb of the urethra; I fear too that the patient, in whom the œsophagus was found "destroyed for the extent of two inches at least, at an inch and a half above its passage through the diaphragm"—a patient who had been treated by means of dilating bougies with apparent success by M. Carrier—was really its victim.

Stricture.—Since Mauchart established the analogy between coarctations of the urethra and those of nearly all the mucous canals, surgeons have attempted, at various times, to apply to strictures of the œsophagus nearly all the treatment useful in those of the urinary canal. Mechanical dilatation is one of the first attempted to be employed. It was advised by MM. Richerand and Dupuytren, and once put to the test by MM. Carrier and Jallon upon a merchant of Orleans, who for a month was better, but sunk in the end with an ulcerous destruction of the canal of deglutition; applied by M. Boyer in 1797 in the case of a woman who derived but little advantage from it; and by M. Sanson on a patient who, after obtaining considerable relief, wished to leave the Hotel Dieu, under the belief that further treatment was not requisite; it seems to have been attended with complete success to Migliavacca, cited by Paletta, to Mr. Home, Mr. Earle, and Mr. McIlvain. The catheter is the instrument for effecting it. Bougies, whether emplastic, elastic, conical rather than cylindrical, or still better hollow catheters, employed so as to be able gradually to increase their size, should be here managed with the same reserve, and the same prudence as in the urethra; but the canal being larger, or requiring to be brought to greater dimensions, the volume which it is at first necessary to give to these instruments has made it desirable to substitute for them other apparatus. That of Mr. Fletcher, curved, slender, and made of

metal, is formed of three branches, which a central staff, armed with a head, separates or approximates at pleasure. After being introduced beyond the stricture, the movable axis is drawn back, so that the branches insensibly separate to the degree which the surgeon thinks proper. Though ingenious as it may appear, this instrument should be rejected. It is from equal compression, and not only at these points of the constricted circle, that dilatation offers a prospect of success. It is most particularly necessary that this indication be exactly fulfilled, which Mr. Fletcher seems to have entirely forgot. The air dilator of Mr. Arnott, and the flexible seton carrier recently devised by M. Costalat, to reach deep strictures of the rectum, and particularly of the urethra, will have incontestible advantages over it. I will recur to these under the articles *urethra* and *rectum*. Many surgeons have also directed their views to cauterization. Although this mode of treatment has not yet been tested among us, and M. Boyer has deemed it necessary to proscribe it formally, with the conviction that no experienced and prudent surgeon would be bold enough to attempt it, it is not so elsewhere. In his excellent work just published, on Chronic Affections of the Œsophagus, M. Mondiere shows that it has been employed in Italy, England, and America. A flexible staff, armed with a piece of lint soaked in a caustic liquid, was carried by Paletta as far as the stricture, and the patient, who died some weeks after, was at first relieved. Rejecting justly all fluid substances, Sir E. Home preferred the nitrate of silver, and has used it seven times. Four of his patients were cured, and the other three sunk under the natural progress of their disorder. Of three cases reported by Mr. Andrews, of Madeira, only one did well, the two others could not be saved. Lastly, Messrs. Ch. Bell and McIlvain have declared in its favor, as Darwin had done before, and appear to have used only the nitrate of silver. The difficulty that first presents is to know the nature of the stricture to be treated. Those which depend on chronic phlegmasia, induration, or a lardaceous transformation of the mucous coat, or the adjacent layer, admit of the trial of cauterization; but how distinguish them from lesions caused by tumors, cancerous or fungous degenerations, ulcers, aneurisms, polypi, &c.? The urethra being as it were not subject to any but the first, does not occasion this kind of embarrassment. Its small diameter, its superficial position, and the arrangement of its parietes, render its mechanical dilatation easy and almost without danger. The œsophagus surrounded by yielding tissues, and naturally very dilatable, is far from presenting in this point of view such advantageous circumstances. In holding apart the sides at the contracted point, bougies merely throw outwards the projection which tends inwards, and the disorder returns almost immediately on the suspension of the treatment, which therefore is only palliative. As to the nitrate of silver it is less in the character of a caustic than of a modifier of the morbid condition of the part that I would be willing to employ it. In this view the exactness with which we touch one point rather than another, is less important than may be thought. It is, for the rest, a subject which will come under the treatment of the urethra.

§ 2. *Foreign Bodies.*

Incision into the œsophagus, first promulgated by Verduc, formally

proposed by Guattani, practised for the first time by Guattani in 1730, and since by Roland, is an operation which is only applicable to two particular cases; first for the extraction of a foreign body, which, by its presence in the œsophagus, endangers more or less the life of the patient; secondly, for the artificial introduction of nutritive substances into the digestive passages in case of impassable stricture of the inferior part of the pharynx.

In the first case, before proceeding to œsophagotomy, every means should be tried to make the foreign body return by the natural passages, unless it is of such a nature as to be pushed into the stomach without danger. A crust of bread, a piece of tripe, large lumps of hard and coriaceous food, skin, a slice of fruit, a sugar-plum, a morsel of cake, the rind of bacon, a whole egg, a chestnut, a pear, a fig, and all solid substances which enter into the composition of food, may lodge in the œsophagus and give rise to serious accidents. However, as these various bodies are more or less soluble in the juice of the digestive passages, it is rare that they do not in the end descend into the stomach. Pebbles, pieces of glass, fish bone, a piece of coin, a knife handle, a fork, and a thousand different foreign bodies, of which the memoirs of Hevin and Sue contain so many examples, are much more dangerous, although the organism has more than once triumphed over them without assistance. They tear or contuse the parts, and produce inflammations and abscess and horrible pains, which have often no end but death. To the numerous facts already given by authors, it would be very easy to add a host of others. MM. Gibert, Murat, Bard, &c., have recently added to the list, and practitioners meet with new cases every day. Thus, Dumortier has seen the presence of a piece of money in the œsophagus produce perforation of the primitive carotid; and M. Begin gave, in 1828, the case of a soldier, in whom the trunk of the thoracic aorta was opened in the same manner by a five-franc piece. When their presence is evidently capable of doing injury, and when the organism is unable singly to remove them, three modes may be employed before proceeding to open into the œsophagus. To push it into the stomach, to force it to return by the natural passage, and to prevent, or meet with energy if they already exist, the symptoms which may arise.

1st. *Propulsion.*—Only those bodies should be pushed into the stomach which, being too difficult to remove by the mouth, are not dangerous to the patient if once out of the œsophagus. Water, swallowed in abundance, large mouthfuls of bread, beef, buiscuit, figs turned inside outwards, prunes freed from their stones, pieces of sponge tied to a thread, long bougies lubricated with oil, slight blows on the back with the fist as recommended by De la Motte, and rarely omitted by common people, and I know not how many other means have been proposed and successively practised with advantages more or less marked, and often again without any kind of success. In this case, the leaden staff of Albucasis and Rhazes, the ball of the same metal cast and fixed on the end of iron, silver, or brass wire, so highly approved by Mesnier, Verduc's silver rod terminating in an olive, the curved sound, &c., are far from always succeeding. In all this I can see scarcely any thing but the pear-headed staff generally used since A. Pare, and the ball of lead, which is really worthy of any confidence; still will it be necessary that both these instruments be made with flexible rods, capable of following with-

out difficulty the tortuous form of the mouth, pharynx, and œsophagus, yet with sufficient solidity however to prevent their breaking during the operation.

2d. *Extraction.*—When the fingers cannot reach the foreign bodies engaged in the pharynx or œsophagus, there should be used long forceps, a little curved; like the urethra forceps of Hunter for example. The crotchet, or wire hook of Reviere or Perrotin exposes the tissues to be torn upon its being withdrawn, as was experienced by Petit, of Nevers. By tipping it with a button, Stedman really improved it; and M. Dupuytren, who substituted a long silver wire terminating in a ball at one end and a ring at the other, making it an exploring instrument, a kind of catheter when straight, and using it as a hook by bending it, has rendered it easier of management. The crotchet of F. de Hilden would be much more dangerous; that of Petit, made of a double flexible wire of silver, twisted and bent in the manner of the palpebral elevator of Pellier, has nothing against it but its want of firmness. The stylet or whalebone rod, carrying a bunch of small movable rings, extolled by the same practitioner, and which De la Faye modified by merely fixing threads of flax to the small ring of a stylet of the ordinary catheter, is not to be despised when the body to be extracted is uneven and of small dimensions. The noose of packthread or twine, which Mauchart had occasion to praise, the sponge tied strongly to a thread and carried below the foreign body by means of a large leaden sound, to the end of which it is fastened, by drawing on the two ends of the string brought back, one through the canal the other along the external face of the instrument, as practised by Brouillard; the same substance attached to the end of a whalebone rod, as described by Willis, of an ordinary catheter, or the leaden, or copper sound, perforated with holes, borrowed from Arculanus or rather from Ryff, and modified by Hilden, who, to render it stronger, added to it a leaden stylet; the sponge, which Hevin enclosed in a pouch of lambskin or silk to prevent its dilating before descending low enough; which Petit fixed to the end of a slip of whalebone, enclosed as far as its handle in a flexible sound made of silver wire wrapped spirally; which Quesney covered with intestine of sheep; which Ollenrotz suspended to the end of a chain or chaplet composed of sixty-one balls of tin, may have in every one of those ways its particular application; as also the kind of brush, mop, or broom, the *excutia ventriculi* mentioned by Wedel, Teichmeyer and Heister, and which the English, who call it *provendor*, form of small pieces of linen, or a bunch of hog's bristles at the end of a piece of whalebone, or brass wire. The manner of using these various instruments, whether for forcing into the stomach or extracting by the mouth the bodies in question, is too easily understood to require more to be said of it. The same may be said of their relative value in the different cases in which more than one of them would be applicable. The skillful surgeon will select the best, the most simple, the most certain, and the most inoffensive among those within his reach. The forceps with multiplied branches, which are opened and closed by a peculiar mechanism before and after seizing the foreign body, and which M. Missoux described, in 1825, in his thesis under the name of Geranorhynque, although ingenious, is too complicated for adoption. That just proposed by M. Blondeau, and which is founded on the principle of the litholabe forceps, enclosed in a flexible sheath, would answer a little better

if it were not also too complex. The same must be said of the ingenious apparatus recently invented by M. Parent.

3d. The efforts at *vomiting*, which many authors have advised us to provoke (notwithstanding the objections of B. Bell) either by tickling the palate or the bottom of the fauces, or by gorging the patient with warm water, or in any other way, form a resource which we should not employ but for bodies free from asperities or any projecting points, or after having vainly tried the two kinds of resource pointed out above, and only then that we may not have to reproach ourselves with recurring too quickly or without necessity to œsophagotomy.

4th. *Œsophagotomy.*—Although this operation was not formally proposed by any one before Verduc and Guattani, yet it must be admitted that the idea may be found in other and older authors. The opening of the abscess containing a small bone which had escaped from the œsophagus, and approached the integuments of the neck, already practised by Arculanus and Plater; the fish bone extracted in the same manner by Houlier and Glandorp; the opening of tumors of more or less density and volume developed on the same region, by Kerkring, Rivals, &c. naturally led to it. But wounds of the œsophagus until then had been considered so dangerous that practitioners had need of numerous facts and direct experiments to dissipate their fears and their scruples. Since œsophagotomy has taken its station among the regular operations of surgery, it has received, like almost every other, various degrees of improvement. Guattani who was not ignorant that the œsophagus is situated a little more to the left than to the right of the trachea, advises to make a transverse fold of the skin, and make an incision from the level of the cricoid cartilage down to the sternum on the left side of the neck, to separate the lips of the wound with hooks, and arrive by degrees at the œsophagus, and divide it parallel with its fibres. According to B. Bell the place of incision is by no means fixed; for it is proper to make it always upon the projection caused by the foreign body. He knew, besides, that by these precautions the recurrent nerve would be easily avoided. To be more certain of not opening a vessel of any size, Richter advises the muscles to be separated by an ivory knife. The method of Echoldt, praised I know not why by Sprengel, which consists in making the incision fall upon the triangular space which separates the roots of the sterno-mastoid muscle, seems to me to deserve the oblivion into which it has fallen. Sir Chas. Bell says, that if the thumb be placed on the course of the internal jugular vein to make it swell during the incision of the skin, the platisma-myoids, the nervous filaments of the cervical plexus, and while the other muscles are separated with the handle of the scalpel, the œsophagus will soon, in some measure, present itself, and in this manner œsophagotomy is not dangerous; but this author is evidently deceived as to the value of such a precaution. M. Richerand, who admits œsophagotomy only in cases where the volume of the foreign body is considerable enough to make it project beyond the surrounding parts, and who maintains with reason that it is almost always at the entrance of the canal of deglutition that these bodies lodge, simply adopts the process of Guattani or B. Bell. In this hypothesis, indeed, the external projection is a sure guide to the œsophagus, and favors the separation of all the organs which it is important to save. An instrument devised by Vacca, allows, in every case, the same end to be fulfilled. It is a long metallic staff terminating in a knob, and split in the form of a forceps at one of its extremities. This staff slides

in a canula, which presents laterally an opening several inches above its termination. The whole instrument is introduced closed until arrived beyond the foreign body. The surgeon then draws the forceps gently towards him, when one of its branches, from its own elasticity does not fail to be engaged in the lateral hole of the sound, which forms its sheath and pushes out on the side of the neck the several layers to be divided. But the barbed sound invented by Frere Come for the supra pubic operation is, without doubt, far more convenient than the instrument of Vacca, if a conductor is necessary when œsophagotomy is performed. By raising all the soft parts to the left and front with the beak of a common catheter previously carried down to the body to be extracted, as proposed by M. Roux, the carotid artery, the jugular vein, and the pneumo-gastric nerve necessarily remain posteriorly; the thyroid vessels themselves and the trachea are also sufficiently distant to remove all danger from pushing his dart from within outwards, which then is used as a grooved director, in lithotomy. However, it is unnecessary thus to grope in the dark. Nothing prevents cutting first, layer by layer, the several tissues which separate the œsophagus from the integuments, and only using the sound in the last stage of the operation. In this manner œsophagotomy has nothing dreadful nor difficult, and may be performed by every surgeon. Strictly speaking there is nothing to prevent the substitution of an ordinary sound for that of Frere Come.

Manual.—The patient is placed as for tracheotomy, only that his face is turned a little to the right. Standing at the left, armed with a straight bistoury, the surgeon divides the integuments and the platysma-myoides to the extent of two or three inches upon the anterior edge of the sterno-mastoid muscle, between the sternum and the larynx, and as directly as possible opposite the foreign body, whose situation he has previously discovered, either with the blunt staff of M. Dupuytren, the barbed sound, or other instrument; turns this muscle outwards; displays the omo-hyoid and sterno-hyoid muscles; divides them in turn; tears with the beak of a director, or divides carefully with the bistoury, the fibro-cellular layers which are found a little deeper, as if for tying the primitive carotid artery; raises and pushes inwards and forwards the thyroid body, continues with the same precautions as far as the lateral groove between the œsophagus and the trachea; introduces the arrow sound by the mouth, if he chooses to employ it; makes its tube project through the œsophagus at the bottom of the wound; fixes it with the left thumb and index finger; directs an assistant to push its stylet; carries the point of his bistoury on the grooved concavity of this staff, and makes an incision on the œsophagus proportionate to the size of the body to be extracted. When the conductor is not employed, the canal is first to be opened on the side by a small puncture, to permit a conductor to be immediately carried into its interior, and the wound then enlarged with a bistoury or blunt scissors. If the substance to be removed does not present at the opening just made, it is to be sought for with forceps or any appropriate instrument. The wound may be united by the first intention. If an artery of any size be wounded, it is to be obliterated by a ligature. A gumelastic œsophagus sound is to be carried through the nostrils or mouth into the stomach, and is not to be removed before the third or fourth day, in order that food and drink given to the patient during this time may not prevent adhesion of the wound, and be infiltrated into the tissues of the sub-hyoid

region. I learn from M. H. Larrey, that a patient operated on after these principles at the Val de Grace, was perfectly restored. The anomaly published by Steadman, Kirby, Hart, Godman, and Robert, of a carotid or subclavian twining spirally round the œsophagus, or gliding under its spinal surface to reach the side of the neck, will not cause danger unless the operation be performed too low down.

CHAPTER II.

The Chest.

SECTION I.

Tumors.

Art. 1.—*Extirpation of the Mamma.*

Compression, employed from 1809 to 1816 by Yonge, rejected in 1817 as dangerous by the Middlesex physicians on the report of Charles Bell, introduced again by Pearson, has recently afforded to M. Recamier results worthy of fixing the attention in the treatment of tumors of the breast. Up to the month of September, 1829, this practitioner had obtained ten instances of complete success, four of very decided improvement, and four others of more moderate encouragement, out of thirty patients whom he treated. In the greater part of the other cases it rendered removal much more easy and certain, by reducing the tumor to the smallest possible size, and in some measure insulating it from the surrounding parts. But this is not a reason for rejecting the operation, nor as some seem to think for leaving it as a desperate remedy for a desperate case. Many women cannot endure compression, however well applied. Many cases invincibly resist it. Under the most favorable circumstances, the assiduous attentions which it requires for months, are of themselves sufficiently wearisome to suggest the question, whether extirpation ought not to be preferred. It is not, in fact, as an operation that extirpation of the breast is dangerous, but because it is frequently followed by a return of the disease. The amount of pain which it causes is assuredly less than what results from a treatment which must continue from two to three months. In an instant the patient is rid of the disorder. Fifteen days to a month ordinarily suffice for the completion of the cure. On the other hand, there is no reason to believe that the relapse will be less frequent after the use of the bandage than by removal of the scirrhus. Observation has already proved, that if it become necessary to discontinue the compression without having entirely resolved the morbid mass, the progress of the cancer impeded for a moment soon becomes more frightful than before.

To the question whether extirpation is a means which may be reasonably tried, I do not hesitate to answer in the affirmative. To Celsus who forbids us to touch cancer because it always returns; to Avicenna, who never saw the operation followed by complete success; to Monro, who proves that only

four women out of more than sixty whom he knew had had no return of disease at the end of two years; to M. Boyer, who out of more than a hundred cases could only cite a very small number of radical cures; to Rouzet, who professes to have found in the Annals of Science but equivocal proofs of permanent cures, may be opposed the testimony of Hill, who met with but twelve unsuccessful cases out of eighty-eight extirpations of cancers, for the most part ulcerated, although all his cases had occurred from two to thirty years before; that of B. Bell who confirms the statement of Dr. Hill; that of Dr. North, quoted by Dorsey, and who in a hundred cases remarked but a very small proportion of relapses. MM. Richerand, Roux, Dupuytren, and before them Sabatier, have on their part had proof that cancer is far from always returning when extirpation has been performed in time. It is also within my knowledge that many patients operated upon at Tours by M. Gouraud, at the hospital St. Louis by M. J. Cloquet, at the hospital of the School of Medicine by MM. Boyer and Roux, or by myself, from two to ten years since, continue in good health. Cancer of the breast is not an external sign of general disease, as maintained by M. Delpech, at least most frequently, except in an advanced period of its development. In the majority of cases it is at first but a local affection, but one which continually tends to pervert the solids and fluids to such a degree as to be reproduced, in some part or other, although it seemed to be entirely destroyed in the place of its first attack. Consequently nothing can be more dangerous than to defer its removal under vain pretexts; and compression, necessarily less efficacious, is to be proposed only to pusillanimous patients, or to those who from some other reason will not submit to the knife. If general or local medications are of any value, the operation, which is by no means incompatible with their use, can only contribute to their success. It would be wrong to be imposed upon by the presence of some swellings about the axilla or in the sub-clavicular region. These tumors may have preceded the scirrhus, or be the effect of it, without partaking of its nature. Bartholin, Borrich, Assalini, and Desault have seen them spontaneously disappear after amputation of a cancerous breast. The same remark has of late been frequently made. This was the case with a woman, treated in 1825 by M. Roux, at the "Hospice de Perfectionnement," who had a row of hardened glands extending from the side of the neck into the hollow of the axilla. A slight yellowish tint, a commencement of what is called cancerous cachexia, does not always form an absolute contra-indication. Having to treat a patient in this condition, Morgagni operated against the formal advice of Valsalva. The cancer returned at the end of five years. Morgagni operated again, and the disease was not reproduced. Adhesions of the tumor to the ribs diminish considerably the chances of success, but do not render it absolutely impossible. The operation ought, therefore, to be performed whenever the roots of the disease may be extirpated without occasioning too great a loss of substance, and when there is no evidence of its actual existence in other organs.

History.—That extirpation of the breast still causes so much terror in the ordinary ranks of society, is to be attributed to the barbarous processes which have been employed at various periods. Cauterization of the wound, with an iron moderately hot, mentioned in the writings of Galen; the precepts of Leonidas to burn, at each stroke of the bistoury, the bottom of the incision, to

prevent hemorrhage; excision with a knife heated to whiteness, or when the cancer is adherent, with a blade of horn dipped in aqua fortis, as prescribed by J. Fabricius, must truly have been accompanied with horrible pains. The process of Scultetus, which consists in passing two threads crossed through the tumor to lift it up, cutting it off at a single stroke with a large concave bistoury, and then cauterizing all the bleeding surface with a plate of red hot iron; that of Purmann, who added to these threads a tight ligature on the the root of the disease for the purpose of benumbing the parts; those of Nuck, who used a double hook and falciform knife; of Dionis, who began by plunging into the cancerous mass his famous Helvetian forceps, so much spoken of at the commencement of the last century; of Hartmann and of Vylhorne, who, after strangulating the tumor at its base, fixed it with a kind of forceps, afterwards with the *bident* of Helvetius, while a mechanical instrument of their invention performed the excision; of Schmucker, who after dividing the skin, pressed the tumor to make it project, passed through it a kind of awl somewhat bent, and then separated it from the surrounding parts, were also well calculated to excite similar fears. Those who caused the tumor to drop off by surrounding it with a ligature dipped in aqua fortis, or who, after completely or incompletely excising it in any manner, applied at several times arsenic, orpiment, potassa, butter of antimony, &c.; they who dissected minutely all the surrounding vessels for the purpose of placing a double ligature around each, and cutting without fear between the two before removing the cancer, and who after the incision of the integuments used only their fingers and terminated the operation by extraction, did nothing towards inducing the public to change their opinion on this subject. At the present time, when removal of the breast is reduced to its greatest simplicity, there is nothing in it terrible or really cruel. When the skin is not diseased, and the tumor is neither voluminous nor adherent, the surgeon merely divides the common integuments, taking care to give the incision all the proper extent, and to have its lips separated, while with a hook, or even the ends of the fingers, he draws the scirrhus outwards, and with the other hand armed with a bistoury destroys all its cellular and vascular connexions. When the patient is of a certain *embonpoint*, or when the nipples are naturally very much developed, although the carcinoma be very much circumscribed and preserves all its mobility, there is some advantage in not thus saving the skin in cutting out an ellipsis of more or less extent. The operation is thus rendered easier and more prompt. Its success will thereby be rendered more probable, for the sides of the wound, being almost perpendicular, are in better condition to be exactly brought together than if the whole of the integuments had been preserved. If the skin itself is included in the disorganization; if it is red and too thin ever to resume its primitive character; if it adheres by its under surface to the morbid mass, we are obliged to follow the same precept and include all the diseased portion between two incisions which should always comprise a certain extent of the sound parts. On the whole, it is better to remove too much than too little, provided enough is left to close the wound immediately. The circular incision, adopted by many of the ancients, and by Dionis in particular, is essentially defective. It forms a wound extremely difficult to cicatrize, and the loss of substance which it occasions is much more considerable than in any other mode of operating. The elliptical incision used by Paulus Ægineta,

and since by Cheselden, &c., is the best of all. The crucial incision, preferred by Palfyn and Heister, the T incision used by Acrel, and even by Chopart, are evidently less advantageous, and are adapted only to particular cases. Some, with Gahrliep and Sir Ch. Bell, make the great diameter of this incision vertical; others, with Desault, transvere, while the precept of Pimpernelle, laid down by Verduc, which consists in directing it obliquely from above downwards, and from without inwards, that is, in the direction of the fibres of the pectoralis major, is generally followed by the moderns.

The advantage of being better able to apply the means of union in the first case, is more than compensated by the risk of cutting perpendicularly the muscular fibres, and of finding difficulty in bringing outwards the sternal portion of the integuments. The second process is liable to the same inconveniences without offering the same advantages. Consequently the oblique incision, which permits as well as any other, the use of the strips, and which leaves untouched the facia of the pectoralis major, or at least divides it only in its longitudinal direction, deserves the preference which is now generally given to it. Strictly speaking, any cutting instruments will serve for this operation; a razor or amputating knife would do in case of necessity. The bistoury, with a broad square point, invented by M. Dubois for the purpose of more certainly avoiding the chest, is not of more or less value than any other. The common straight bistoury, or better, the convex bistoury, is what is commonly used. To prevent the blood which flows from the first incision from impeding the execution of the second, surgeons begin, as directed by Palfyn and Desault, with the inferior. Yet there is an advantage after division of the integuments, in dissecting the tumor from above downwards. In the other direction, the inferior or external edge of the pectoralis major would be much more exposed to the knife. For the rest, no one now regards the advice of Horne, Lapeyronie, and Le Dran, to begin with a crescentic incision, and not complete the ellipse which the wound is to represent until after having detached the cancer, proceeding all the time in the same direction, and then to cut through the skin from within outwards. This mode, however, has no other defect than of rendering the end of the operation a little less regular, and being likely to remove too much or too little of the cutaneous covering. When the loss of substance is considerable, so as to render the coaptation of the division impossible, or at least very difficult, M. Lisfranc proposes to insulate each margin of the wound from the parts beneath for one or more inches, in the hope of thus removing every obstacle to their approximation. This is a modification, the full value of which I believe has not been felt till now. By this means enough skin is always found to cover immediately the solution of continuity. The integuments are then borrowed from the surrounding parts as in the cheiloplasmus, and this must be a valuable resource when it is necessary to remove a great portion of the tegumentary envelope. The arterial branches which are divided belong to the external mammary, the superior thoracic, the internal mammary, or the intercostal arteries. It is always towards the outer side that the largest are found, which are first to be attended to. By casting a ligature about them as soon as they are opened there is no fear of their retracting and being lost in the tissues, nor that the action of the air will prevent their being found afterwards; but the operation becomes thereby much more tedious and pro-

longed. If they are not too numerous nor very large, I prefer that an assistant should close them with his fingers as soon as divided. If after cleansing the wound some remain which cannot be found they are commonly too small to cause any uneasiness. Moreover, in the opposite case it would be easy to establish mediate or immediate compression over them, so that on this point there is really little cause for apprehension. When the wound is to be healed by the first intention, ligatures are not always indispensable. Theden never applied them. Petit and Le Dran usually dispensed with them. D'Arce and Vanhorne, who also omitted them, extracted the tumor with the fingers, and only used the bistoury for dividing the integuments. I dispensed with them upon a strong and plethoric young woman from whom I had just removed a scirrhous mass as large as the fist. Prudence, however, requires that all that can be seen should be tied or twisted, and that if any escape the eye of the surgeon, the dressings should be watched attentively for a day or two. The precaution of not definitively dressing the wound until after several hours, so as to give time for the eccentric action of the vascular system to be re-established, and thus discover the arterial mouths which it is necessary to close, has the serious disadvantage of annoying the patient greatly, and to say the least, of being unnecessary. At present it would be ridiculous and cruel to dissect, as has been advised, and excise afterwards all the veins which go to the breast, or merely to squeeze them with the fingers to drive out the black or atrabiliary humor, so much dreaded by the ancients. Immediate union, advised by Paul and Gahrliep, praised by Nannoni, who confined himself to bringing the lips of the wound together; by Cheselden and Garengeot, who used the suture, and which almost all moderns have adopted, has nevertheless still some opponents. It is correctly accused of preventing the escape of matter if it form at the bottom of the wound; of being frequently followed by phlegmonous erysipelas, and therefore of endangering in a high degree the success of the operation. These accidents, formidable especially to such women as are large or cacochymic, would be most frequently avoided if no vacancy were left at the bottom of the wound, if coaptation were more exact near the muscles than towards the skin, if the strips should act principally on the deep parts, and not on the skin alone, and if care were taken to preserve an issue at the most depending point for the passage of the fluids. For the rest as it is almost impossible to obtain completely immediate union (I succeeded once, upon a man; I had but one artery to twist and the scirrhus did not exceed a small egg in size), perhaps it would be wiser to treat the wound by what may be called secondary immediate union. The cure would not be sensibly retarded, and the patient would have none of these dangers to encounter. As to the suture, although earnestly recommended anew by M. Serre, I cannot dare to advise its use in this place until having seen more fortunate and conclusive results than those yet furnished. It evidently renders the operation more painful, and except some cases in which the skin being thin and dissected up tends to roll upon itself, strips or the simple bandage will fully serve the purpose. Since without it a difinitive cure may take place in from ten to twenty days, I cannot see in what consist its advantages.

Manual.—Although, according to the custom of many practitioners, the patient may be seated in a chair during the operation, there are, nevertheless, incontestable advantages in a recumbent position on a bed or operating

table. Syncopes are then less to be apprehended, and in reality the surgeon is more at his ease. The head and chest are kept sufficiently elevated to render the breast as prominent as possible. The cushion which Bidloo placed in the axilla to push the gland forwards while the arm is drawn backwards would not deserve mention, if Mr. S. Cooper had not advised a precaution somewhat similar and no less strange; he directs, in order to keep the arm from the body, to govern the motions of the patient and to stretch the pectoralis major, that a stick be placed in the axillary hollow on each side between the body and the arm! An assistant raises the tumor with one hand, and with the other sponges the wound. The surgeon drawing the skin in the opposite direction, begins with the inferior semi-lunar incision, depresses the mass to be removed, causes the integuments to be stretched from above; and performs the superior incision, beginning at the external angle of the first wound and carrying it to its other extremity, and thus completes his ellipsis; takes hold of the scirrhus or directs it to be done, dissects it largely first from below upwards, then from above downwards, and so conducts the operation that the diseased gland shall be surrounded with sound tissues, and not be removed alone; goes, or should not fear to go, as deep as the fleshy fibres, and even to the osseous arches of the breast if the disease extend so deeply. If he does not tie the arteries, as I prefer at least when they are not too large, he orders them to be pressed with the finger as they are divided by the bistoury, and may thus finish in a few seconds the extirpation of the largest breast. If some morbid portions escape the instrument at first they should be removed afterwards without hesitation. When belonging to the soft parts they are brought away by the knife or scissors. If the bones be affected a rugine may be necessary. Having gone thus far we should not shrink from removing one or more portions of the ribs, if their excision appear to destroy all the disease; but if, before commencing, this necessity be indicated by any sign, it will be better, in my opinion, not to attempt the operation. If any tumors exist in the axilla, which create apprehension, they are to be laid bare when not too distant, by prolonging thus far the external angle of the wound. In the contrary case it is better to dissect them out by separate incisions. Their situation although capable of exciting fear at first sight permits their extirpation in almost every case without the least danger. They are in fact almost constantly found on the external face of the serratus magnus, so that to keep out of the way the brachial plexus, it is sufficient to raise the arm and hold it from the body. Nothing is easier, therefore, when the wounding of any large vessels is dreaded, than to pass a ligature round the pedicle, after properly insulating them, and then cut them without the knot. This practice, which is advised by J. L. Petit and Desault, and adopted by Zang, Dupuytren, and Lisfranc, ought to be retained. As to opening the veins, it is rarely troublesome with regard to hemorrhage. I have seen M. Roux wound the axillary vein itself in this operation, and plugging was enough for any return of the effusion of blood. Having cleansed the wound and surrounding parts, if immediate union is to be attempted, the operator gently approximates the sides of the disunion, and preserves them carefully in contact with the thumb and index finger of each hand, while an assistant applies the adhesive strips. In general, the longer the strips the better. When spread over a large surface their action is less felt towards the division of the skin, and keep in place much better than if short and more numerous Some persons

of great merit, however, maintain the contrary; and professor A. H. Stevens, of New York, among others directs them to be as short as possible. They should cross the wound at right angles. When the loss of substance is considerable, or when the integuments are with difficulty brought in coaptation, there is an advantage in fixing them behind the sound shoulder, and bringing them over the clavicle, carrying them below the axilla towards the flank of the diseased side; the middle one is first applied, and those of the ends the last. Their number must necessarily vary according to the extent of the wound, over which they should form a *grillage* quite close, whenever a primitive adhesion is desired, otherwise it is but to leave considerable spaces between them, that the pus or other fluids, if any be produced, may not be retained. A pledget of lint spread with cerate, one or two dossils of dry charpie supported by a body bandage, or circular turns of a long bandage passed once or twice around the shoulders, complete the apparatus, and the patient may be immediately put to bed. When immediate union is impracticable or is not desired, the plaster strips are usually unnecessary. The wound is covered with strips of linen spread with cerate, or a fine cloth oiled and pierced with holes, so that the charpie which is placed above may be easily removed from the first dressing. If, afterwards, the least vegetation or tubercle of a doubtful nature manifest itself, its destruction should be effected without hesitation, and as promptly as possible, either with the knife, fire, arsenical paste or other caustic, as advised by De la Poterie, F. Come, Dubois, Patrix, &c. Cancers which admit the least hope on this subject, belong to the cerebriform, melanare, and scirrhous tissues. Those which seem, and really do extend into the surrounding cellular tissue by a number of diverging radii or roots, are the most formidable of all, and rarely fail to return; while the extirpation of *colloid*, hydatiform, encysted and tuberculous cancers, are, on the contrary, most frequently followed by a radical cure.

Art. 2.—Extirpation of Tumors of the Axilla.

Masses, cancerous or not, may be developed in the axilla without disease of the breast, as well in man as in woman, and there acquire an enormous size, so as to be destroyed only by extirpation. I have published several remarkable cases, and M. Goyraux, has just related another not less so. Whenever they may be removed entire by the base, it should be done as in extirpation of lupi in general. If the clavicle has been raised up and the pectoral muscles extenuated by one of these tumors, it is to be attacked on its anterior face as was done by myself in the case of a young woman twenty-four years old, at the hospital of Improvement in 1828. One of the branches of a crucial incision, directed from the internal third of the clavicle, to the posterior edge of the axilla divided the whole thickness of the pectoralis major and minor muscles. I was obliged to dissect the whole brachial plexus, and to lay bare the principal artery to the extent of two inches, to follow even into the subclavicular hollow, and insulate, as well with the fingers as with the bistoury, the morbid production, which in size equalled at least the size of the head of a new-born child. For those which have acquired less volume and retain their mobility, we are to act in the manner just laid down for scirrhus of the mamella, complicated with swellings of the axilla. What I have advanced in

X from grille a grate

regard to the dangers of the introduction of air into the circulatory passages and wounds of the veins, in speaking of extirpation of the goitre, being equally applicable here it is not necessary to revert to it.

SECTION II.

Effusions.

Art. 1.—*Empyema.*

Practised since the highest antiquity, the operation for empyema owes its origin, according to fabulous history, to the despair of a certain Phales or Jason, who, seeking death in the midst of battle, received a lance wound in the breast, and was thus cured of an empyema of which no one would undertake the cure. Galen asserts that it was performed in Greece by plunging a red hot iron into the thorax. After being assured of the existence of the collection, at the time of Hippocrates, one of the last intercostal spaces was opened with the bistoury or a lancet wrapped with linen to within a certain distance of the point. For fear of evacuating too quickly all the morbid matter, others perforated the fourth rib with a trepan, and then closed the opening with a plug or tent. The Arabians seem to have acted on this point in the same manner as the Greeks and Romans. With all, we find that the operation for empyema, which was at first recommended and employed without repugnance by most practitioners, in the end was recommended by none. Paulus Egineta, among the first, directs in its place cauterization of the thorax, and Aly Abbas, among the second, formally rejects it. G. de Salicet and Guy de Chauliac, mention it with extreme timidity. A Benedetti, I. de Vigo, and A. Pare, succeeded in raising it but for a moment from the discredit into which it had fallen, and it required no less than all the efforts of J. Fabricius to bring it again into repute; so that in reality, it is only since the last two centuries that its advantages and disadvantages have been discussed, and that it has again fixed the attention of surgeons. At present it is rarely used, perhaps too rarely; and it is yet to be demonstrated, whether the kind of anathema which the moderns have hurled against it be legitimate and just in all its points.

Sanguineous Effusion.—Whether the blood which accumulates in the pleuræ be given out by the intercostal arteries or the deep vessels, whether it come from a traumatic lesion, a penetrating wound of the chest, or a spontaneous rupture, whether it be arterial or venous, the dangers which result, and the assistance to be rendered, are in all cases nearly the same. The advice of the ancients, who direct the immediate removal of the extravasated fluid, either by placing the patient on the wounded side, or by enlarging the wound, or by using the mouth, a cupping glass, or syringe, to pump it out—an advice generally followed even until of late—far from being advantageous, appears on the contrary to be extremely objectionable. The injured vessels cannot be obliterated and closed, except under the influence of coagula more or less solid, and of some compression. If, instead of being retained within the chest, the blood escape, this compression will not be established by coagula, and the hemorrhage will only end in death. Reason therefore prompts to close immediately the wounds of the chest instead of

dilating them; to imprison in the interior the extravasated fluid, instead of procuring it an issue. If the extravasation is inconsiderable, absorption will most commonly remove it; in the contrary case its source can only be stopped by its own presence—by the mechanical reaction which it exerts upon the wounded organs; so that the operation for empyema belongs in no manner to recent traumatic hemorrhages of the thorax. Some facts collected from the time of Vigo and Pare, a passage of Francois d'Arce, another of G. Horst, the words of Sharp, and especially of Valentine, ought to have pointed out the way to this truth; but it was reserved for A. Petit, and M. Larrey to demonstrate it and gain the admission as a principle by all modern surgeons, that the first indication in penetrating wounds of the chest, with or without extravasation, is to close them immediately. If in the end the organism, aided by a well directed general treatment, continues unable to remove the morbid collection; if when the wounded vessels have had time to become obliterated this collection threatens of itself serious accidents, it is then proper, but only then, to have recourse to the operation, and to make what is called a counter-opening.

Effusions of Pus.—As purulent collections in the chest are far from being always the principal disease, the operation for empyema is, in its turn, far from being always of great assistance in the case. If the cause is ascertained to be a tuberculous vomica or any other incurable lesion of the pulmonary organ, or an extensive alteration still existing of the heart or pleuræ, the opening of an issue only hastens the end of the patient, If, on the contrary, the collection is the consequence of a simple phlegmasia, a pleurisy for example; an abscess in the lungs opening into the pleura—in a word, if after removing the pus, we can hope to stop its source, the operation offers some chance of success and ought to be tried, if nothing in the general condition of the patient contra-indicate it. A peasant from the neighborhood of Tours, operated on under these circumstances, in 1814, by M. Gouraud, was perfectly restored. In the cases to which it applies, the extravasation approaches the nature of an external abscess. The organism has, most frequently, taken care to surround it with adhesions which more or less circumscribe its limits; so that, after the opening is made, there is nothing to fear from contact of the air with the rest of the pleura. In proportion as it is emptied, its parietes can gradually close upon themselves, and soon entirely obliterate it. The same remark may be applied to sanguineous effusions, which in the end are almost always crowded into a space more or less contracted, under the influence of adhesive inflammation of the surrounding surfaces.

Serous Effusions.—Serum does not give the same chances of success. The surfaces which furnish it are not sufficiently irritated, at least generally, to contract mutual adhesion. The lungs somewhat compressed towards its root, is then incapable of resuming its natural dimensions; and the chest, once opened, brings the whole extent of the pleura in contact with the atmosphere, so that in such a case many experienced surgeons reject even the idea of an operation. However, if all the means which reason and experience indicate have been tried in vain, if it is not certain that an incurable organic lesion is the cause of the extravasation, and if alarming symptoms such as those of suffocation threaten the life of the patient, the operation for empyema is a last resort, which it would be inhuman not to attempt. M. Gouraud, who ably

defends this hypothesis, obtained by it a remarkable success in 1808, and in scientific compilations are found here and there some other examples. The artificial subtraction of a part of the extravasated fluid excites in such a degree absorption in the pectoral cavity, that a number of practitioners have thought it should become a precept that the operation for empyema should follow pleurisies when resolution cannot be expected. The patient mentioned by M. Martin Solon, who is one of its declared partisans, died. The same was the case with a patient operated on in 1830, at La Charite, and with another whose thorax was opened at the hospital St. Antoine, during my period of service.

Effusions of Gas.—The presence of air or gas in the interior of the pleuræ, which so many physicians have found there since M. Itard made it the subject of an interesting work, whether owing to the rupture of a pulmonary cell, to the decomposition of certain liquids, or to a pure and simple exhalation, is however one of the circumstances which may in strictness require perforation of the thorax. Riolan and H. Bass have had proof of it in patients whose chests, instead of pus which they expected to find, contained in reality only air. The researches of A. Monro, of Gooch, and particularly of Hewson, leave not the least doubt on the subject. But it must not be forgotten that it is a symptom not serious of itself, and capable of spontaneously disappearing, and that if it is coincident with profound organic alteration, the operation for empyema will only have a momentary triumph. Although a mere palliative in the majority of cases, perforation of the thorax will yet sometimes effect a complete cure. If formerly it was frequently performed without necessity, it appears to me that at present we have fallen into the opposite fault, in too generally proscribing its use.

Operation.—The dangers that attend it are easy to be conceived. If the lung, a long time compressed, has not lost its natural permeability, the air rushes in with force immediately after the substraction of the effused fluid, and may thus become the cause of irritation or violent inflammation. Supposing this organ to be so compressed as to yield only gently to the mechanical action of the atmosphere, the kind of vacuum which is formed immediately around parts which have been exactly sustained until then, necessarily disturbs pectoral circulation and respiration. Without being injurious or irritating of itself, as many authors still admit, yet the air most commonly exerts a dangerous influence over the sequelæ of the disease. Introduced into the chest through an opening generally very small, it becomes warm and mingles with the morbid deposite which covers or bathes the pleura, combines by mutual decomposition with the remaining effused fluid, which quickly assumes an acrid and putrid character which is foreign to it, the action of which is but ill borne by the organism. It is this new substance and not the air which inflames the environs of the disease, and produces general reaction, sometimes very intense and too frequently fatal; it is this also, which penetrating in greater or less proportion into the mass of circulating fluids, infects them and gives rise to those adynamic phenomena, of which a number of unfortunate patients thus treated are the victims. The danger will then be in proportion to the extent of the parietes of the collection, the degree of exhaustion, irritability, strength, and vital resistance of the patient, and also influenced by the nature of the effused fluids, and the condition of

the thoracic organs. Three points deserve the attention of the surgeon in the operation for empyema; 1st, the place in the chest where it should be performed; 2d, the instrument most proper for its performance; and 3dly, the requisite dressing.

Place of Election.—When the effusion is not circumscribed by any adhesions, and the pleuræ are entirely free, it is advised to open the pectoral cavity at the point most depending and most favorable to the issue of the fluids, and this point is called the *place of election.* When the collection occupies only one portion of the chest, and is so limited that neither the position nor the movements of the patient can make it change its place, the opening must be made on a determined point, and this is called the *place of necessity.* This has never varied, and cannot according to the whim of practitioners. The other, on the contrary, being an affair of choice, could not be expected to be, and in reality has not been, the same with all surgeons. Some, with F. Walther for instance, have fixed it in the fourth intercostal space, counting from above downwards; others in the fifth, with Leonidas and Fabricius d' Aquapendente; others in the sixth, with Sharp, B. Bell, &c.; and Heers directs it to be in the seventh. There are some, who like G. de Salicet and Lanfranc prefer the eighth; others, with A. Pare, the ninth. Solingen thinks that the tenth, directed by A. Lusitanus, for the left side, and the ninth for the right, are best; in fine, Vesalius and Werner say that the eleventh offers the most advantages.

At present the general preference is given, in France at least, to the third on the left, and the fourth on the right. Lower down, the diaphragm and the liver may be wounded, and the instrument may be carried into the peritoneum and strike below the collection; higher, we would miss the most depending point, and the liquid will not flow with the desirable facility. To these reasons, it is true, it may be objected; first, that in abundant collections the diaphragm, and the liver with it, are too powerfully forced downwards to be injured even when we penetrate between the second and third rib, secondly that we may change at pleasure the depending point of the thorax by the position given to the patient, and that in this point of view, the sixth or the ninth intercostal space is nearly as advantageous as the third; but as there is no disadvantage in following the precept established amongst us, it may as well be conformed to as another, and the more so as the feeling of suffocation which habitually torments patients affected with effusion into the thorax, renders it difficult for them to use any other than a sitting or nearly vertical posture. I do not see, however, why we should be confined too rigorously to strike rather above the third than the fourth rib when there is any difficulty in distinguishing them. The intercostal space being once determined, it remains to decide on what point of its length the operation is to be performed. Near the sternum the internal mammary may be wounded; more externally are found the descending and anastomosing branches of this artery. On the side of the spine is the mass of the sacro-lumbalis and longissimus dorsi; a little further on the side of the trunk the intercostal artery being as yet uncovered, and unprotected by the inferior edge of the rib, may be easily opened. It is therefore with reason that the point of union of the posterior third with the anterior two thirds of the pectoral boundary has been selected. There the opening falls in front of the latissimus dorsi, between the faciæ or

digitation of the serratus magnus and the obliqus externus. There are only the integuments, the intercostal muscles, and the pleura, to be divided. The artery lodged in the costal groove, is not yet bifurcated, and the space is sufficiently large to admit the end of the finger. However if this point did not offer the very great advantage of being the most depending, when the patient is gently inclined to one side, sitting, or lying, there would be little disadvantage in going more behind or to the front, as David and some other practitioners have recommended. Many means have been proposed to determine exactly the position of the third intercostal space. If the patient is lean and not anasarcous, the ribs may be counted from above downwards, but when œdema or a thick layer of cellular or adipose tissue covers the bars of the thorax, we are obliged to act otherwise. According to some, when the hand of the patient is applied in front of the sternum, and the arm hanging along the side of the trunk, the elbow pushed a little back corresponds exactly to the space sought for. This mode of exploration, besides being very incorrect, is more proper to designate the space between the last two ribs than between the ninth and tenth, and that which consists in penetrating into the chest at six fingers' breadth below the inferior angle of the scapula, would be much more certain and rational if such a determination had really the importance formerly bestowed upon it.

Formerly it was an affair of great moment to mark the place of necessity in the operation for empyema. If no tumor be manifest, or no external indication; if the use of a cataplasm, which should dry up quickly according to some, on the contrary remain humid according to others, opposite the effusion, indicate nothing, it will be necessary to refer to the feelings expressed by the patient, to succussion, or perhaps to means still more fallacious. But the labors of Avenbrugger, of Corvisart, of Laennec, and of M. Piorry have happily removed this uncertainty; so that at present it is almost as easy to detect the precise seat and limits of disease in the interior of the chest as if they were on the surface of the body.

Instruments.—To guard against hemorrhage, or to obtain a wound with loss of substance, or because they attributed some particular virtues to escharotics, the ancients and several authors of the middle ages frequently employed caustics, chemical or metallic, for opening the chest. The contemporaries of Leonidas employed a cautery in the shape of a fruit stone. Cinesius, mentioned by Galen, also used the red hot iron. That of Rhazes was fine and pointed. Albucasis used one of a triangular form. A. Pare directed it to be furnished with a concave plate at some distance from its point. But this method, long since abandoned by the moderns, would scarcely deserve mention if it had not been extolled by M. Gouraud, who applied it particularly to collections of pus, and who attributes to hot iron the advantage of permitting the abscess to empty itself after the eschar comes away; and to the wound that of opposing the entrance of air, by the swelling of its edges. The *scolopomachairion* of Paulus Egineta, the *phlebotome* of the Arabians, and the *sagitella* of Arculanus, which were formerly used, have disappeared from practice. The common bistoury and the trocar now supersede all other instruments in tapping the chest. Although Pare proposed the punch for paracentesis, in order to perforate a rib in preference to an intercostal space, yet it has only been since Drouin and Nuck that attention has been really

directed to this point. Dionis, Heister, and particularly Morand, have pleaded the cause of the trocar, which still reckons many partisans, and has the advantage of rendering the operation easy, prompt, and but little painful, and the entrance of air almost impossible; of not forcing the collection to be emptied at once, and in fine, of allowing a great number of punctures in cases in which they may be deemed necessary. But as its canula has the disadvantage of not always giving free issue to matters of some consistence, such as grumous pus and blood partly coagulated, it is far from suiting every case indiscriminately. Thus it is not generally preferred except in hydrothorax, and extensive pleuritic effusions. But there is nothing to prevent a small puncture from being transformed into a large wound immediately, if the liquid does not flow readily at first; and I cannot see why the lung or the diaphragm runs more risk of being wounded with this instrument than with any other. Paracentesis of the chest is in other respects governed by the same rules as paracentesis abdominis, of which we shall treat hereafter.

If the intention of the operation is to remedy an effusion of air, the wound generally requires no treatment. In the other cases the manner of proceeding is not so clearly laid down. In truth, the *pyulcon* of Galen, cupping glasses, syringes, and suction so much lauded in the sixteenth and seventeenth century, for the removal of the very last particle of the effused fluid; the various species of canulæ for a long time used, and twice by Hey to prevent the pleura from collapsing too soon, and for emptying the chest by degrees, have long since lost nearly all their reputation, although practitioners still deliberate whether or not it is right to evacuate at once the seat of the morbid collection, to keep in it a foreign body to act as a filter, and make injections rather than heal the orifice immediately. Unless the lung enjoy all its expansibility, which is very rare in hydrothorax, there is undoubtedly an advantage in letting the serosity escape but little at a time, and in introducing a strip of linen or a tent of charpie into the cavity of the pleura, so that at each dressing a new flow may be produced. When the case is an empyema, properly so called, or is an effusion of blood, this tent ought not to be neglected if any importance is attached to the non-admission of air into the cavity. In other respects, the rule of conduct is the same as in paracentesis with the trocar. The employment of injections demands all the solicitude of the surgeon. It is the abuse of them by the ancients that has induced the moderns almost generally to proscribe them. They are improper in hydrothorax and in effusions which are not bounded by any adhesion. In other cases, on the contrary, their advantages cannot be contested. As soon as the suppuration tends to become corrupted, they alone are capable of preventing adynamia and decomposition of the fluids, by cleansing the morbid surface and bringing out the altered matters as they are formed. It is therefore evident, that the precaution of raising the skin while perforating the intercostal space, in order to bring at different heights to the opening of the pleura, and that of the integuments, is hardly necessary, and far from deserving the importance generally bestowed upon it since Bass elevated it into a precept.

Manual.—A convex bistoury, a straight bistoury or a trocar, a vessel to receive the fluid, a strip of scraped linen a yard long and of the breadth of the finger, several pledgets of charpie, compresses, and a body bandage, together with a gum elastic canula and a syringe, are all the objects necessary. Seated

on his bed, rather than on a sofa or chair, and inclining more or less to the right side, the patient is kept in this position by assistants, so that the intercostal space to be opened may be stretched as much as possible and quite free. Placed in front and somewhat to the right, the surgeon stretches the skin with his left hand, and with a bistoury in his right divides it parallel with the superior edge of the lower rib, from left to right for the right side, but in the contrary direction for the left; cuts in the same direction, successively layer by layer, the adipose tissue, a thin laminæ of cellular substance, the external muscles of the chest, if any exist at the point selected, and the external and internal intercostal muscles; having arrived at the pleura, and in order to pierce it without fear of wounding any other organ, uses only the point of the bistoury, resting with its back on the end of the left index finger which serves it as a guide; gives to the internal opening an extent of from six lines to an inch, and thus penetrates into the interior of the cavity whence the fluid is seen immediately to flow. If, as is frequently observed, some factitious laminæ are attached to the internal surface of the pleura, there is so much the less reason for stopping at this difficulty, as we may in strictness penetrate ever the substance of the lung itself if the seat of abscess be there. The point is not to miss the morbid sac. Nevertheless, in the case where this point may have been overlooked, unless the matter be within a distance which permits us to feel its fluctuation with the finger, it would be much better to make a second opening in the proper place than to break down the surrounding adhesions, either with the finger, the handle of a knife, or a probe, or especially with a bladder carried empty through the wound, and then filled with air or liquid while in the thorax, which was recommended by some old writers.

Process of the Author.—The motives on which is founded the perforation of the wall of the thorax with so much preparation, seem to me unworthy the sanction they have received. What is to be feared from penetrating by a single thrust into the pleura? To touch the lung. But this accident is not possible except in case the instrument deviates from the direction of the disease. Besides, the lung is free and sound behind the wound, and then the pleura is no sooner opened, than the pressure of the atmosphere forces it towards the spine, unless intimate adhesions unite it to the thoracic parieties, and in this case what danger can result from a small puncture of its parenchyma? I think, therefore, that the operation for empyema would be infinitely more simple, and equally as certain, if in performing it we were to pass through suddenly, and without hesitation, the intercostal space with the bistoury held in the second or third position, that is as in external abscesses which are opened from within outwards. In this manner will be united in some degree the advantages of paracentesis with those of incision, and the opening of the chest, which at first sight appears so formidable, will in reality scarcely deserve the title of an operation.

Remarks.—I designedly omit the precept of those who direct before incision of the integuments to make a large perpendicular fold of them over the ribs, instead of stretching them with the hand, and of others who have thought the incision of the skin should be perpendicular and not horizontal. It is sufficient to mention such counsels that every one may estimate them at their proper value. I will say still less of the method of Mercati, which consisted in penetrating only to the pleura without touching it, that the fluid itself

might complete the perforation. It would be equally puerile to finish the operation with the lancet after using a bistoury for commencing it. The intention is, to arrive surely and without danger within the pathological limits. Nothing can present less difficulty, and this is certainly not the reason why the operation for empyema should appear so formidable. An effusion, considerable enough to require surgical aid, would destroy the patient if it existed on both sides at once before we could think of the operation. On a contrary supposition we must follow the advice given formerly by A. Benedetti, to open the two laminæ of the pleura, with an interval of several days, and to take all necessary precaution to prevent collapse, and shrinking of the lungs. If the operator does not wish the wound to remain open, he brings its lips together when there is nothing more to be extracted from the seat of disease; keeps them in contact by a strip of diachylon; covers it then with charpie; afterwards a compress; and fixes the whole with a body-bandage moderately tight. If he has not removed the whole of the matter, a flat dressing with charpie spread with cerate is ordinarily sufficient to obviate the too speedy adhesion of the edges of the perforation. To be more at ease on this point, however, there is nothing to prevent the insertion in the solution of continuity with the porte-meche, of a little cone of charpie, or one of the extremities of the linen band prepared for this purpose; for the rest every thing is conducted as above. The tents, which were formerly employed for the same end, and which were fastened without by means of a thread, besides the inconvenience of forming a stopper, were also liable to escape into the morbid cavity and be there lost, an example of which is given by Guy. As long as the fluids which are discharged at each dressing preserve their primitive character, and do not deteriorate, injections will only be injurious. On the contrary, we should have recourse to them when the least change is manifest. In this respect, warm water, at first honied barley water, weak lime water, then lead water, or a weak decoction of kino, are to be successively or alternately tried, as well as any other detersive, astringent, or antiseptic fluids, which the practitioner may choose according to the indications. M. Bache affirms that this method, long since adopted in the hospital of Grenoble by M. Billery, who besides was in the habit of closing the wound with a plug of gentian in the interval of the dressings, was often followed with complete success. The apparatus lately devised by M. G. Pelletan, which by means of canulæ and valves, permits the establishment of a double current of liquid by opposing the introduction of air into the thorax, an apparatus in other respects founded on that of M. Heroldt, is too complicated and of too little necessity for practitioners to consent to its use.

Art. 2.—Wound of the Intercostal Artery.

Supposing a wound of the diaphragm, of which Solingen says he was witness, should occur during the operation for empyema, there is no resource but that of medicine to be summoned against it, and the opening of the intercostal artery is in fact the only accident which can here require surgical aid. Although rare, this wound has occupied the attention of writers, so that a greater number of means have been proposed to overcome its effects than the times it has been observed; unless perhaps it has been frequently mistaken, or the remedy has been neglected even in cases in which the resulting effusion has become fatal, an example of which M. Thierry published in 1828. It

has mostly occurred in consequence of penetrating wounds of the chest. It is recognized by the hemorrhage it occasions, by the symptoms of effusion which result, by the pallor, and threatened syncope, &c. A piece of card carried to the bottom of the wound and bent into a gutter shows on what side the blood escapes. The finger passed under the rib often distinguishes a hot jet not easy to mistake, and forms one of the most certain means of diagnosis when it can be employed. By means of a thread carried through the wound, and brought out through the intercostal space above, Gerard conducted a tent beneath the artery which he hoped thus to compress by strangulating it with the rib. Not willing to withdraw the conducting instrument entirely through the new wound, Goulard invented a needle with a curved handle, like that of Gerard, pierced with an eye near its point, and hollowed on its convexity into a groove for carrying the ligature. Heuermann contends, that with a needle considerably bent and fixed at an angle with its handle, it is possible to surround the bone so as to bring out the two extremities of the thread at the same wound. Having made a second opening above the rib, Leber used it to carry a tape which he brought out of the wound, and then tied its two ends over a conpress, in the manner of Gerard. For this purpose he employed a flat flexible sound, for which Steidle substituted a silver one bent into the shape of an S, to which, in his turn, says Sprengel, Bœtscher preferred a blunt probe-pointed one of steel. In fine, instead of tying the thread into a knot, Reich advises to pass its two extremities into a gumelastic canula which is kept without the chest; but all these processes are unnecessary, as well as the double plate of Lottery, the ivory counter of Quesnay, and the machine of Bellocq. The tent, tied round its middle by a very strong thread, carried through into the cavity of the pleura, and then placed vertically, so that by drawing on it it cannot be brought away, compresses the artery, and at the same time the edges of the two adjoining ribs no longer receives the eulogies lavished on it by Bilguer, Richter, Desault and Sabatier. Theden maintains, that to arrest the hemorrhage it is sufficent to complete the division of the artery, bend back its posterior end, and plug the wound. I add, that the same end may be attained without bending back the vessel, as has been well observed by Hebeinstreit. It is scarcely explained how Læffler could have proposed to open the intercostal space a little further behind, leaving the pleura untouched, in order to divide the artery at this point, and there apply a tampon, without at all obstructing the flow of effused matters through the first opening. Rejecting all these means, Bell found it more convenient to seize with a hook the end of the bleeding vessel and tie it. There are some who have had the courage to establish a point of compression over the wound of the vessel for several days by the fingers of assistants, who relieved each other alternately. In a word there is no kind of useless or unapplicable resources which have not been devised for this occasion. None however have remained in practice. Supposing it necessary to act, the hemorrhage may be easily arrested, by pushing into the chest, in the manner of Desault and Zang, the middle of a fine compress. After filling this species of sack with charpie or tow, to transform its internal portion into a kind of ball, its external portion will only have to be closed and drawn up so as to compress from within outwards until the blood ceases to flow. This small apparatus can be fixed without the least difficulty, by tying the free portion of linen over a second roll of charpie.

This means, the only one to which M. Larrey was willing to give assent, if from any cause it is not deemed proper to make immediate union of the wound, being applicable in every case, offering the advantage of being always at hand, and of being within the reach of every one, should take rank of all the rest, and unquestionably deserves to be substituted for them.

Art. 3.—*Paracentesis of the Pericardium.*

The idea of opening the pericardium when filled with serosity, pus, or blood, at first appeared so bold that many still regard it as rash and inapplicable. Timid surgeons have been deterred from it through fear of wounding the heart. Others reject it, because it may provoke inflammation, which in consequence of its locality would quickly bring on death. The difficulty of recognizing the disease with certainty during life, and the danger of removing only a symptom, is the argument which the most reasonable have advanced against it. None of these different motives however is sufficient to proscribe it absolutely. With the exploring means which the science at present possesses, the experienced practitioner will rarely fail of establishing with all desirable precision the diagnosis of effusion in the pericardium. The heart can always be avoided. By evacuating a morbid fluid from a serous membrane we free it from a foreign body, and in this respect puncture is more calculated to diminish than to excite inflammation. With the operation, the patient it is true runs great risks; but without it he is devoted to a speedy and certain death. If paracentesis does not cure, it may at least afford temporary relief. It is to be regretted that experience furnishes scarcely any light, and that on a subject so grave the ideas are purely theoretical. Senac, who is considered as having committed a fault in first proposing puncture of the pericardium, gives no case of it, and the observation attributed to him by Sprengel has reference to a true hydrothorax. Van Swieten and H. Welse, to whom M. Rayer refers, express themselves still more vaguely. Riolen who treats it as a common proposition, does not however say that it had been performed in his time. It is known that the pretended pericardium which Desault opened was nothing more than accidental cyst. It does not appear that M. Skielderup has given any thing conclusive in support of his advice. It is evident also that the collection opened by M. Larrey had its seat without the envelope of the heart. The three observations reported by M. Romero, the substance of which is also given by M. Merat, are too incomplete not to leave a doubt upon the mind. That which Mr. Jowet of London has published as a first successful case, in 1827, is equally incapable of removing all difficulty from the subject; but if it still remains to be proved that paracentesis of the pericardium has ever been performed on the living subject, there are not wanting facts to prove that perforation of this membrane does not necessarily produce death. The thesis of M. Sanson jun. contains several. M. Larrey quotes several; and I myself have met with one very remarkable. A coalman, who died of pneumonia at the hospital of Improvement in 1824, had received some years before a stab with a knife in the left side of the thorax. On opening his body, we found a very old cellular band, which ran obliquely from the wall of the thorax to the mediastinum, and was continuous with the anterior edge of the lung, which adhered like it to the external surface of the pericardium. The point of this

last organ, around which were spread the preceding bands, was pierced with a round opening with thin edges, and capable of admitting the finger. The corresponding region of the heart presented a cicatrix easy to be recognized, but which we could not trace into the ventricle. The part was exhibited to the Academy by M. Bougon the next day, and every member of that body can confirm the correctness of what I say.

Manual.—In its natural condition the pericardium is accessible to the surgeon by a number of points. By distending it beyond measure, effusions render it still more easy to be reached.

Trepanning the Sternum.—Riolan advances, and others agree with him, that the sternum may be trepanned at an inch above the xiphoid cartilage in performing the puncture of the cardiac cyst. This doctrine, reintroduced as a novelty with all its necessary details by M. Skielderup, has found some followers among the moderns. Laennec among others adopts it, and endeavors to deduce from it the advantages of avoiding with certainty the internal mammary artery, of reaching infallibly the distended pouch, and of not opening the pleura. *Senac* directed the fifth or sixth intercostal space to be opened a little to the left of the sternum, and through this the trocar to be plunged very obliquely downwards, and to the right into the collection to be evacuated. In order not to wound the mammary artery, *Desault* made his incision more outwardly, and entered the morbid sac only after feeling the fluctuation with his finger. This is also the mode praised by *M. Romero*, who, instead of the trocar like Senac, or the blunt bistoury of Desault, preferred scissors for dividing the envelope of the heart, after raising up a fold of it with the forceps. Lastly, *M. Larrey* says that it is better to traverse from below upwards the space which separates the left margin of the xiphoid appendix from the cartilage of the last true rib; that the pleura is thus spared without any risk to the peritoneum, the diaphragm, or the internal mammary artery, and that thus the most depending point of the pericardium is reached.

Trepanning of the sternum is unquestionably the most simple process that has been devised. The bone to be penetrated is soft, superficial, and devoid of bloodvessels on both its surfaces. It allows the pericardium to be seen and touched before being opened, and the last stage of the operation to be abandoned; the only one to excite apprehension if the surgeon have previously mistaken the seat of the disease. The fluid cannot be poured into the pleura. I see no other inconveniences, than that of occasioning a loss of substance which renders immediate union of the wound difficult, and inevitably brings the interior of the sac in contact with atmospheric air. But is it not better to leave the puncture of the pericardium open than to close it before stopping the source of the disorder? In this case, is not the action of the air more to be desired than dreaded? The danger to the pleura, no matter what precautions are taken to avoid it, and to the internal mammary artery in Senac's method slightly modified by Desault, Remero, and Jowet, does not allow it to be brought in comparison with the preceding method. The process of M. Larrey, which may rigorously conduct to the same end as trepanning the sternum, is not of so easy application as its inventor seems to think, on subjects in whom œdema, infiltration, or natural *embonpoint* is sufficient to prevent the skin from immediately touching the external face of the bones or cartilages of the chest. Besides, the branch of the mammary artery, which crosses the

anterior face of the ensiform prolongation, is sometimes so considerable, that a wound of it, which is almost inevitable, may create a troublesome hemorrhage. It seems to me, therefore, prudent to act according to the advice of Riolan, repeated by M. Boyer. The crown of the trepan is to be applied over the left half of the sternum immediately above the xiphoid appendix, so as to fall on the widest point of the anterior separation of the mediastinum. The left index finger carried to the bottom of the wound will then afford certainty of the fluctuation, and serve as a guide to the bistoury. The pericardium being opened, it will be proper to turn the patient on his left side, and more than ever to keep his chest in a position almost vertical, to give issue to the fluid, which should be permitted to flow slowly. The dressing consists of a tent of charpie carried to the orifice of the serous sac, a pledget of lint spread with cerate, compresses, and a body bandage to keep the whole in place, as in the operation for empyema.

Injections.—The idea of treating hydrops pericardii as an hydrocele, by injecting an irritating fluid into the diseased membrane to provoke adhesive inflammation, has nothing in it repugnant to sound reason, though some have unjustly made it a crime in M. Richerand to have advanced the doctrine. If besides the evacuation of the fluid the puncture does not itself produce this adhesion, it is useless to rely on its success, except as a mere palliative. The radical cure of hydrocardia without obliteration of the altered sac is no more possible than that of hydrocele. If it has ever been obtained, it was because the practitioner without intending it fulfilled the design proposed, first by M. Richerand, and since by Laennec. The contact of the air might perhaps suffice to bring on the necessary degree of inflammation. When there is no organic lesion, tepid water, or some other gently irritating fluid should be first tried. If there is an effusion of pus, the injections should be varied as in the treatment of empyema. In every mode I would direct the opening in the pericardium to be large and kept open to the end. There would then be a treatment analogous to that of hydrocele by incision or excision, and the effusion which naturally follows an injection into the tunica vaginalis after puncture, will not endanger its result. However, these are but suppositions. Before according them any value, and applying them to man, we ought by experiments on animals to determine to what extent they are well founded. It is a point of practice which possesses considerable interest. The rarity of occasions which call for their application, seems to me to be the only plausible reason which diminishes their importance.

CHAPTER III.

Abdomen.

SECTION I.

Effusions.—Cysts.

Art. 1.—*Paracentesis.*

Puncture of the abdomen in dropsy is one of the oldest operations in surgery. To accidents, of which history furnishes examples without end, is owing the first suggestion. Nothing in truth is more frequent in the annals of science, than cases of ascites cured in consequence of a wound of the abdomen. A child amusing itself one day with a knife in the yard of a dropsical peasant, says Guyon de la Nauche, was thrown by one of its play fellows upon the wretched patient, and cut open his abdomen. A large quantity of water flowed from the wound, and at the end of some weeks the patient was radically cured. Another ascitic, finding no surgeon willing to make the puncture resolved upon doing it himself. As it had been forbid to leave any thing in his way, which might enable him to accomplish his object, he broke the glass he used for drinking, and shaped a piece, which he plunged below the naval. A complete cure was the reward of his temerity. No doubt the same remarks have given rise to the same ideas since the remotest antiquity, and that paracentesis abdominis is as old as medicine.

Indication.—When ascites is the effect of an incurable affection of any organ contained within the abdomen, it is evident that puncture will not triumph over it, and that in such case it can only be used for the temporary relief of the patient. But if the dropsy is *essential* and idiopathic, the removal of the effused fluid cannot but favor the action of the general treatment, and powerfully conduce to the re-establishment of health. In the first case the operation should be deferred as long as possible, and resorted to only to prevent suffocation. In the second, there would probably be an advantage in following the advice of Duverney and Bertrand, renewed by M. Broussais, to give an early issue to the effused fluid. It is so rare to see ascites terminate happily, that, after the ineffectual employment of the means which experience seems most to accredit, compression for example, which I saw once succeed in a lad fourteen years old, at the hospital of Tours in 1818, the advantages of which are praised by M. Godele of Soissons, the good effects of which were experienced at the Hotel Dieu during the past year, and the efficacy of which has been placed beyond doubt by M. Bricheteau, it may well be permitted to appeal to the operation, however feeble the chances of success.

Examination of the Processes.—Red hot iron which was formerly in use, caustic with which an escar was first made, which it was afterwards necessary to divide in order to penetrate the peritoneum, and the *seton* proposed by others, have long since given place to more rational modes. The method of

Paulus Egineta and Guy de Chauliac, a method which was still praised by Pigray, and which consists in dividing the integuments with the *bistoury* between the pubis and the umbilicus, and then passing through the aponeurosis or the muscles a little higher up, so as to make it possible to close at pleasure the deeper opening, by slipping over it the skin first divided, is also abandoned, as well as all others which require a cutting instrument. The *needle* of Thouvenot or of Barbette, evidently pointed out by Rhazes; the instrument of Block or Girault; the trocar canula of Sanctorius, the invention of which Camper refers as far back as Hippocrates, variously modified by other authors, particularly by J. L. Petit, who made of it the very perfect instrument known at present under the name of *trocar* or *trois-quarts*, render the puncture of the abdomen so simple and easy, that for a century past there has been no more discussion of the bistoury or the lancet than of the cautery, for penetrating the peritoneum of an ascitic. Some modern surgeons however seem to have revived the use of the incision. Dr. Physick, among others maintains that the operation is much less painful with the lancet than with the trocar, and Dorsey says, that in America this last instrument will soon fall into disuetude. More recently Mr. Calaway, a surgeon of London, has endeavored to prove that the lancet should really have the preference in puncture of the abdomen. Directed by the left index finger, which serves it as a *point d' appui*, it is plunged with the right hand into the linea alba above the pubis; a female catheter is then introduced into the peritoneum, and for the rest there is nothing peculiar in the operation. This process, recommended by Petit-Radel in l'Encyclopedia Methodique, the same moreover with that of Cœlius Aurelianus, may be imitated without inconvenience, but it is doubtful whether it has in reality any real advantage over the method adopted among ourselves. If the instrument come in contact with any vascular branches, it infallibly divides them; and all the organs within its reach must share the same fate, while the trocar turns aside and displaces rather than cuts the movable organs which present themselves before it. The wound which results from its passage closes as soon as it is withdrawn. That made by the lancet, on the contrary, remains open, and offers no obstacle to the serosity which tends to lodge in it. The flat trocar of Wilson, that of Andre, which according to the advice of B. Bell many practitioners of Great Britain prefer to the instument of Petit, because say they, it scarcely differs from a cutting instrument, is altogether unworthy of this predilection. The jointed trocar, those with a conical point, or like a serpent's tongue, or more or less flattened instead of being triangular, and the fifty other forms recommended, scarcely deserve to be mentioned. That which has received the approbation of French surgeons leaves something to be desired, and the modifications of which it has been the subject since J. L. Petit are only calculated to injure it.

Place of Election.—All points of the abdomen are not equally proper for paracentesis. The *left flank* would be the most favorable when the spleen is sound, if the epiploon, more extensive on this side, did not oppose an obstacle to the flow of the liquid. *On the right* the presence of the liver is to be feared. Too *near Poupart's ligament* is found the sigmoid flexure of the colon or the cœcum. Posteriorly is the last false rib or the crista of the os innominatum and it would be easy to reach the lumbar colon. The *sub-umbilical zone* corresponds to the transverse portion of the large intestine

Quite *low* on the median line is found the bladder. However, it is necessary to act on a depending point. The *linea alba* preferred by the ancients, and even now by most English surgeons, has no advantage in this respect: it is far from being as free from liability to hemorrhage as is imagined. A large vein sometimes courses along its anterior face. Mr. S. Cooper mentions a case in which more than a pint of blood flowed from the wound he made in this place with a bistoury. In the female there is between the uterus and the rectum, a cul de sac in the bottom of the pelvis, which may be easily reached through the posterior and superior part of the *vagina.* This point, the most depending of all, would also be the most proper perhaps, if the peritoneum was always free through its whole extent, if a change of relation of the bladder of the uterus on the intestines did not expose some of these organs to be perforated. We should therefore choose and conform to the precept of Henckel, of Watson, of Bishop, of Nœthig, only after being assured by the touch that the serosity descends into the pelvic cavity, and tends to depress the roof of the vagina. By penetrating through the rectum above the vesiculæ seminalis as some other practitioners direct, there would be still more danger of wounding the bladder. The fear of then finding stercoracious fluids to pass into the peritoneum, will always be reason enough to reject this mode, although by way of exception it may be adopted in some subjects. Every mode of emptying the peritoneum of ascitic collections, even by puncturing the bladder itself has been occasionally resorted to.

Berard gives a case of this in his thesis. There was thought to be an ischury. The sound was carried forcibly through the urethra. Several pints of serosity escaped.—The patient died. The autopsis proved that the subject had been ascitic, and that the instrument had entered the abdomen. A London surgeon, Mr. Watson, has seriously proposed to enter by this passage, and what is no less surprising, Mr. Buchanan, one of his countrymen, is said to have performed it three times with success, but I do not think that among us this precept will ever require a serious refutation. The *scrotum* which answers best, as proved by the observations of Ledran and Morand, when together with ascites there exists congenital hydrocele, can only be used in this circumstance. If there be found a part of the abdominal parietes thinner than the rest, in such a degree as to be formed of the skin alone, and having acquired a kind of transparency, it is there that we should act, however unfavorable it may be in other respects. The *umbilicus*, which often presents this peculiarity, and was recommended by Lanfranc and the two Fabricii, is the point wherein M. Ollivier, founded on an observation entirely his own, and another of M. Bigat of Angers, proposes to perforate in *pregnant women.* M. Scarpa, and after him M. Cruch direct, on the contrary, that during pregnancy the puncture be performed in the left hypochondria; that is, a little below the third false rib. I have several times had recourse to paracentesis on women in a state of gestation; among others, three times in the course of one pregnancy; and the whole extent of the left side, all the points of this side where the trocar is usually inserted, appeared to me separated from the uterus by a sufficient interspace to leave no great importance to the precepts of Ollivier and Scarpa. A little without the linea alba, where the operation was formerly performed according to the advice of Celsus, the epigastric artery runs some risk. The middle of the space between the margin of the ribs and

the crista of the ileum, indicated by Sabatier, would have the inconvenience of being too near the chest, when the spleen and liver are the seat of an engorgement; so that as a general rule the middle of a line drawn from the umbilicus to the anterior spine of the ileum is still the best. The instrument cannot touch either the bladder or uterus, unless it be very much developed; or the epigastric artery which runs within; nor the anterior iliac artery which is without; nor the colon which is found below and behind. This place, which the majority of operators have prescribed since Palfin suggested the idea, is then the true place of election, and each of the others the place of necessity. In ordinary ascites a wound of the intestines or their arteries is almost impossible, the serosity naturally throws them towards the diaphragm or the spine. Even when they remain free and floating, the mesentery is not long enough for the trocar to reach them. But if adhesions fix a part of it to the parietes of the abdomen, no doubt the instrument may open them and give passage to fecal matter; cases of which have been reported. *Encysted dropsy*, which has its seat in an ovary, in the cavities of the omenta, in a portion of peritoneum bounded by adhesions, or in a peculiar accidental sac, will also render the same thing likely to occur. Surrounded by thicker walls it obliges us to penetrate deeper before arriving at the cavity, and consequently requires us to distinguish it if possible before commencing the operation.

Position of the Patient.—No one now advises the patient to be kept standing during the operation. The sitting posture is not more proper except under particular circumstances. He should be placed on his side near the edge of the bed. While the liquid flows, an assistant on the opposite side, with both hands spread out, moderately compresses the parietes of the abdomen. Without this precaution, which the ancients neglected, the viscera and the large vascular trunks being suddenly relieved from the pressure to which they had been accustomed, occasion syncopes, lipothymiæ, and convulsions, which it is important to avoid. The bandage or corset invented by Monro to supply the place of the assistant's hands, and serve as dressing after the operation, only imperfectly fulfill the intention, and does not deserve the preference given it by some. To apply it beforehand, to tighten it in proportion as the abdomen is emptied, to keep opposite the proper place the hole which is in it for the passage of the trocar, and then to fill the hollows that may be left in the iliac regions, &c., are affairs too minute for surgeons to be confined to without necessity. The cloth passed around the abdomen, its two extremities drawn gradually by assistants while the water flows, as recommended by Mr. S. Cooper, is still more improper. If the effusion has its seat in the peritoneum, it is possible that the epiploon, a knuckle of intestine, a flake of albumen, or a hydatid, may present at the extremity of the canula, and close it before the complete extraction of serosity. A stylet or blunt staff carried through the instrument is always sufficient to remove these obstacles, and clear the passage for the fluid to run with its original freedom. Serous cysts, containing scarcely ever any thing but limpid serosity, are generally free from this kind of inconvenience; but dropsy of the ovary, which almost constantly forms an oily or gelatinous substance more or less thick, rarely very fluid, presents sometimes, and requires a canula of considerable size.

Extraction of the Fluid.—Many authors are of opinion that the whole of the fluid ought not to be removed at once; that it would be better only to take

it away gradually. With this intention, Paulus Egineta, Guy de Chauliac, &c., avoided piercing the skin and the peritoneum on the same level; in the time of Hippocrates they placed a small canula in the wound, which has been modified a thousand times since, and which they employed as a kind of spigot to stop and unstop at pleasure; others drew off at first but a certain quantity of the morbid fluid, repeating the same operation successively a greater or less number of times; and after opening the abdomen with a lancet it has been proposed to let the matter issue of itself slowly and insensibly. But experience having obtained nothing very positive as to the value of such a mode, it appears more reasonable to leave in the abdomen only what cannot be extracted. Exhaustion and syncope, which the ancients hoped thus to prevent, are more certainly avoided by a bandage properly applied; and patients would be only half satisfied, if their abdomen was but half emptied after they have submitted to be tapped.

Dressing.—The compressing bandage after tapping has not only the advantage of supporting the viscera, but is also a powerful means of determining a definite cure. The authentic cases adduced in support of this assertion are now of sufficient number to induce us to multiply them more and more. Last spring I was requested by Doctor Rousseau, physician at Batingnolls, to tap a child five years old, who had been affected with ascites for eight months. We drew six pounds of limpid fluid from the abdomen. No alteration of the viscera could be detected through the parietes of the abdomen. An exact and moderate compression was immediately established. The effusion was not reproduced and the little patient soon recovered his former health. The mode of effecting compression in these cases should be left to the invention of the operator. Whether it be made with a flannel bandage as directed by Mr. S. Cooper after Bell, the bandage of Monroe, a kind of lozenge terminating above in a shoulder strap, and below by straps for the thighs, and so as to be properly fastened across, or quite simply, with a body bandage and compresses, or other pieces variously folded over the epigastrium and the sides, provided that it be exact and regular the rest is of little importance.

Injections.—Some think that the radical cure of ascites may be obtained by another method after tapping. By inference from what happens in hydrocele they drew the idea of throwing into the peritoneum irritating fluids to produce adhesive inflammation. Brenner, who seems to have started the idea, and who only wished to strengthen the viscera, proposed a mixture of camphorated *spirits*, aloes, and myrrh. Warrick tried it with *Bristol water* and cured his patient. Repeated with *red wine* and *tar water* the experiment had not the same success. The two patients died. After making trial of the process of Hales, who directed a canula to be placed each side of the abdomen, so that the fluid might return by one as it was thrown in at the other, Warrick in the end gave the preference to the Bristol waters and simple puncture. Although since directed by Heuermann, Bossu, and some others, injections in ascites were entirely proscribed until two years since, when the Annals of Broussais brought forward in their favor two cases of success obtained by the vapor of wine. Emboldened by their example M. Lhomme attempted the same means on an adult who had already been tapped several times. The result surpassed his expectations. His patient, like the one of M. Gobert, continued to do well. A

subject so grave requires more conclusive facts to produce a decision. Nothing proves that M. Lhomme really caused the *vapor of wine* to pass into the abdomen. He filled a syringe with it, as he says; but the cloths wet with cold water with which he thought it necessary to wrap the canula through which it was obliged to pass, must necessarily have condensed it immediately; so that very probably it was the air and not the wine that was forced into the abdominal cavity. The observations of Huermann, of Litre, of Garengeot, of Bossu, seem only to relate to encysted dropsy, and those of Warrick or Warren, are too incomplete to deserve great confidence. Yet it is not improbable that important practical data may one day be drawn from these attempts. Reasoning founded on several facts induces me to think that the cure of ascites takes place only by the adhesion of the parietal peritoneum with the abdominal viscera. The colics which are habitually felt by those who have escaped this disease, and the obstruction which they meet with in their digestive functions, are proof of the fact. A man about fifty years of age, who had been cured of ascites fourteen years previously and who died of pneumonia in the hospital of Tours, in 1817, a girl nineteen years old successfully treated at fourteen years of age for a similar dropsy at the Paris hospital for children, and who died in consequence of cerebral lesion in 1824 at the hospital of Improvement, had all the intestines glued to each other and to the parietes of the abdomen by innumerable cellular lamellæ and filaments. Such being the fact the question remains whether prudence and humanity may be allowed in these cases to attempt to imitate the process of nature. For the purpose of elucidating this fact, M. Bretonneau made, in 1819, some experiments upon dogs. He first injected pure water, brandy and water, and then a strong solution of muriate of soda, into the peritoneum, but no inflammation could be produced in these animals, and all the injected fluids were absorbed after several days. A patient whose condition afforded no hope of success from the use of ordinary means, and who was threatened with near death was submitted to the same experiment. He sunk, but it was under the progress of his disease, and because a part of the fluid was infiltrated into the substance of the abdominal parietes and there produced gangrenous erysipelas. M. J. Cloquet has several times mentioned to me a patient in whom the vinous or alcoholic injection for a congenital hydrocele passed against his intention into the abdomen, and who, after some troublesome symptoms, was finally restored to health. Without wishing to draw from these various trials consequences which do not follow, I still think them worthy of exciting attention. They tend to prove at least, that injections into the peritoneum are not necessarily as dangerous as they are generally supposed; and that before rejecting them absolutely, it would be well to make them the subject of varied experiments and of profound and impartial examination. This question is also presented under a new aspect by M. J. V. Roosbroeck of Louvain, who being struck with the eminent diuretic and sudorific properties of the *oxidulous gas of Azote*, resolved upon injecting it into the abdomen of dropsical patients after tapping. Three patients, one male and two females, thus treated by him, derived such advantage therefrom, that M. Broussais did not hesitate to attempt it in turn, but on a subject whose condition was so desperate that it occasioned surprise that he should survive eight days. The author puts two drams of nitrate of ammonia into a glass vial to which he

adapts a bladder and stopcock; lutes the apparatus, and places it over the flame of a spirit lamp; when the bladder is full of gas from the decomposition of the salt, unlutes it and lets the whole cool; he then fixes the end of the stopcock into the trocar canula and makes the injection. If no error has glided into the statement of M. V. Roosbroeck, practitioners should undoubtedly be eager to repeat his experiments.

Sac of goldbeater's skin.—Will a bladder of this material, as applied to the radical cure of hernia, proposed by M. Belmas, carried empty into the peritoneum or cavity of the cyst, and then blown up or filled with any appropriate fluid, and fastened without by its extremity, have the advantage as this author presumes of graduating the irritation at pleasure, or discontinuing it if necessary by removing the foreign body which occasions it? I cannot think so.

Supposing nothing of this to be done, and that the effusion reappears, tapping is to be repeated as often as it becomes necessary, by the rules laid down above. There are patients whose life is thus prolonged for several years, in whose cases we are obliged to have recourse to tapping every two or three months. Dropsy of the ovary, a disease purely local in the greater number of cases, supports best these repeated operations. Partial or encysted dropsy may also, under some circumstances, admit of it; but is doubtful whether general ascités may be ranked in the same class, or continue long after paracentesis without becoming fatal. Thus when it is asserted, that tapping was performed nine times on the same woman by Saviard, eleven times by Litre, twenty-nine times by Grew, fifty-seven times by Cheselden, forty-seven times by Laub, eighty-six times in the course of twenty-six years, by Martineau, fifty-two times by Schmucker, sixty-five times by Mead, one hundred times by Callisen, and even six hundered and fifty-five times by Bezard, and that the fatal term of this disease has thereby been put off, it is almost certain that they were cases of ovarial dropsy, and not of ascites, in the proper acceptation of the term.

Manual.—The *apparatus* is composed of a trocar and canula of proper size, smeared with cerate, a tub or any large vessel to receive the fluid, a smaller and shallow vessel which may be held quite close to the abdomen, unless the serosity flows with sufficient force to render it unnecessary, a piece of cere-cloth, various compresses folded several times, a napkin to serve as a shield, another folded treble and furnished with straps for the thighs and shoulders. One assistant remains near the head, another near the feet and on the side upon which the patient is laid, in order to support the chest and thighs. A third, placed on the opposite side, and even on the bed for fear of being otherwise too much fatigued, holds himself in readiness to place his extended hands over the whole surface of the abdomen to compress it gently as the water flows. The surgeon takes the trocar and plunges it with his right hand through the abdominal wall, the integuments of which are kept stretched with the left. When inserted briskly and suddenly, the instruments create scarcely any pain to the patient. Many authors, fearing it may go too deeply, and touch some of the viscera, prefer entering it slowly, turning it on its axis, and contend that in this way the arteries are more certainly protected from wound. These reasons have no foundation. The organs of the abdomen, as I have already said, are too remote from its parietes, in ascites, for the trocar

to reach them, although carried in as far as its handle. Making a *point d'appui* on the skin with the two last fingers during the insertion is not much more necessary. Moreover, so many precautions only render the operation more long and fearful. The index finger held alongside the trocar while the handle is held firmly in the palm of the hand, leaves uncovered only as much as desired, and only what is necessary to arrive at the region of the fluid, and is sufficient for the security of the viscera. If the parietes of the abdomen or the cyst are one, two, or three inches in thickness, sufficient in fine to cause embarrassment, of which Saviard is said to have met with a case, if they are so flabby as to yield under the pressure, another instrument is to be employed, and it is in this case that the lancet or bistoury may with some advantage be preferred. The want of resistance announces when it has entered the peritoneum. The canula which is to remain in its place, its head turned downwards, is held by the left thumb and forefinger while the trocar is withdrawn. The liquid gushes out immediately with more or less force, and by a jet very easy to conduct into the bucket designed for this purpose. The buttoned stylet, the chest probe, &c., are only used when some foreign body stops up the canula. After all the water has been drawn off, the operator removes the tube, rotating it and supporting, at the same time with the first two fingers of the other hand, the periphery of the orifice he has made, to prevent the skin from being pulled; he then applies the plaster and compresses over this point, covers thus the whole front of the abdomen and the sides, fixes the body bandage, and immediately replaces the patient in bed in the least fatiguing posture.

Accidents.—Hemorrhage from tapping, although rare, is yet the inconvenience which has the most occupied practitioners. Mr. C. Smith has collected ten instances. It is easily remedied when it arises from a wound of the epigastric artery or any other vessel of the abdominal parietes. For this there are several means, one of them, used in the last century, recommended by Petit Radel, and recently employed with success by M. Cruveilhier, consists in including the whole course of the trocar in a large fold of the soft parts, in compressing or even bruising it a little with the thumb and forefinger until the blood ceases to flow. A small plug of wax, an end of bougie, shaped into a faucet, as devised by Bellocq, or still better a piece of gumelastic or plastic bougie, such as used for the urethra, pushed into the wound so as to fill it exactly, is a resource which seems quite sufficient in this respect. I am not certain however that a piece of prepared sponge would not do better. By imbibing the liquid at the bottom of the wound, this substance will evidently exercise an eccentric compression most advantageously, but it may also happen to break when it becomes necessary to remove it. If instead of escaping without, the blood accumulates within, it will be difficult to perceive it before death. Besides; supposing the contrary, the surgeon would be scarcely better off. What then is to be done in such a case? or where must we look for the deep-seated vessel, which supplies the hemorrhage? For the rest, we must not be imposed upon by appearances. There is sometimes observed on the surface of serous membranes, a sanguineous exudation so abundant as to give to the dropsical fluid the dark color of venous blood, so that at first sight we might suppose it blood and not serosity that flows through the wound. There was a beautiful example of this in an adult affected

with hydrothorax at the hospital St. Antoine, under the care of M. Rayer, while I performed the surgical duty of that establishment, and no doubt the same phenomena may be met with in the peritoneum. The hemorrhage, in consequence of tapping in the median line, mentioned by Mr. S. Cooper, may have belonged to this species. Supposing that the case observed at La Charite in 1824, is not to be referred to pure and simple wound of the epigastric artery, it may be better explained in this way than by a pretended lesion of a mesenteric vessel. M. Piedagnel however relates a case of abundant effusion produced by puncture of an epiploic artery.

Art. 2.—Humoral Tumors of the Liver.

Abscesses, hydatiferous cysts, and encysted dropsy of the liver, have for a long time been regarded by many persons as above all surgical resources. The difficulty of recognising them during life, the fear of producing effusion into the peritoneum, and of the action of the air upon the parietes of the cyst, have generally caused artificial opening to be rejected. However, cases are quoted of cures obtained by means of tapping with the trocar or with caustic potass. Again; incision having of late been the subject of special research, and M. Recamier having arrived at the happiest results by combining these several means, I have concluded to make it the subject of a separate article. Tapping alone will be insufficient when the cyst contains any thing besides limpid serosity. Moreover, it would cause effusion of a certain quantity of fluid into the abdomen, if the protecting adhesions have failed of being established around its course. The use of the bistoury renders this last accident much more likely, and it can only be proper in cases where the diagnosis leaves no doubt of the anatomical relations of the cyst. Caustics, it is said, acting too slowly, are apt to produce general peritonitis in consequence of the local inflammation resulting from their application. In the process of M. Recamier, potass is first applied on several points very near the morbid protuberance, so as to produce by their union a large eschar, which is divided after some days with a cutting instrument. Another dose of caustic is applied to the bottom of the wound, which is to act more in depth than width. Repeated thus successively, cauterization determines with certainty adhesion of the hepatic peritoneum with the peritoneum of the abdominal parietes, and even places the part in condition for the trocar or bistoury to enter the cyst as soon as fluctuation is perceived by the finger beneath the divided eschar. After extracting all the fluid, M. Recamier replaces it by medicated injections, which he renews every day, and retains in the morbid cavity from one dressing to the other by closing the wound with a plug of lint or sponge. By this means the action of the air is prevented, the pus, diluted as soon as produced, cannot stagnate nor pass into a putrid state in the interior of the cavity, and the sac, closing by degrees upon itself, in the end transforms the whole into a simple fistula, which generally is not long in cicatrizing. It is hardly necessary to add that the same treatment is applicable to tumors of the gall bladder, whenever they are found in the conditions established and so well described by J. L. Petit. To make clear the diagnosis in every affection of which we have just been treating, it is often necessary to make an exploring puncture with a very small trocar or a cataract needle, as for distinguishing

with certainty an aneurism from an abscess. M. Recamier remarks with justice, that in this case the instrument should be very fine, and withdrawn briskly from the tissues. Otherwise there will be a wound through which the fluid may become extravasated in the abdomen, or the neighboring organic tissues. From these united precautions, successes, numerous and beyond all expectation have been obtained at the Hotel Dieu of Paris, within a certain number of years.

Another mode of opening morbid collections in the liver or abdomen, proposed in 1827 by Mr. Graves of Dublin, merits a place beside the preceding. This surgeon uses only the bistoury. After cutting freely through all the tissues to within one or two lines of the collection, he stops, fills the wound with lint, and waits until, in a fit of coughing, &c., the tumor opens spontaneously at the bottom of the wound. Mr. Begin has since proposed for all purulent abdominal collections to go thus, layer by layer, as far as the peritoneum, and rest here if there is no adhesion, but if there is to penetrate at once into the cyst. If the tumor be still free, the wound of the peritoneum, which it immediately tends to fill, promptly adheres to it by its anterior face, and three or four days after the instrument may be plunged in without fear of any effusion into the abdomen. Facts sufficiently conclusive have been reported in England and France in favor of this ingenious method.

Art. 3.—Cysts and Tumors of the Interior of the Abdomen.

The ovary is often the seat of a degeneration which authors of every age have noticed, but relief of which has scarcely been thought of except within a century. Le Dran, Housson, Garengeot, had already remarked that tapping scarcely ever removed it, while it was sometimes cured by largely incising the cyst. Morand even advances that extirpation of the diseased organ ought to be performed from the beginning to arrest its development. Observations, communicated by Delaporte and Lieutaud, were summoned in support of this operation, of which Thumin already gives the process, and which two English physicians, Darwin and Power, warmly defended; but, notwithstanding the efforts of M. d'Ischier, the success obtained by Laumonier, the cure of Madame de Choiseul, and the three cases reported by Kapser, the idea of Morand remained without application, when in 1825 Mr. Lizars undertook to invite attention to it, and on their part Messrs. McDowell, Nathan and Alban Smith, put it in trial in America, and MM. Dieffenbach, Chrysmer, and Martini, endeavored to introduce it in Germany. At present a sufficient number of cases are extant to enable us to put a just estimate upon extirpation of the ovaries. Laying aside the operation formerly practised by Lemman, that published by M. Lafflize of Nantes, another of M. Delpech of Montpelier, I will confine myself to the enumeration of the most important—those which have been reported from ten to twenty years since in the scientific journals. The tumor removed by Dr. McDowell in 1809 weighed fifteen pounds, the cure was effected by the thirty-fifth day. In another patient, Dr. McDowell finding both ovaries effected made an incision, a quantity of blood flowed into the abdomen, yet the operation was attended with full success. A negress was relieved by him in 1816 of an ovary weighing six pounds, and was also cured. Two other women whom he treated in the same manner were not so

fortunate; in one the disease remained, the other died. M. Dzondi of Halle succeeded once by means of incision, the use of tents, and subsequent extirpation of the mortified cyst. Pure and simple extirpation performed in 1821 by Mr. Smith was not followed by any accident. The tumor removed by M. Lizars the 27th February 1825, was as large as the uterus at full term. It was necessary to prolong the wound of the abdomen from the xiphoid cartilage to the pubis. The other overy was equally affected, and yet the patient, thirty-six years old, was finally restored to health. Dr. Chrysmer, in the case of a woman thirty-eight years old, had every reason to congratulate himself for having decided on the operation; at the end of six weeks the patient was able to return home. On the 6th May, 1822, Dr. A. Smith, operating on a young woman, extracted the cyst after removing six pints of fluid, and strangulating it at its base with a strong ligature which came away in a month and a half afterwards. In 1824 this lady enjoyed the most perfect health. To these cases of real extirpation attended with success, must be added others in which the tumor has not been wholly removed, or the operation has not been finished as proposed before commencing. In this manner for instance, Dr. Lizars, finding a simple adherent mass in front of the sacro-iliac symphysis, instead of an enormous cyst as he had anticipated, thought proper to confine himself to the first stage of the operation, viz, the incision of the abdominal parietes; closing the wound immediately, he was so fortunate as to save his patient. Mr. Grenville seeing in another case that it would be with difficulty that the cyst could be separated from the surrounding parts, contented himself with incising it largely and emptying it carefully. This conduct gave him complete success. M. Dieffenbach, startled at the size of the base of the tumor and the vessels it contained, seeing moreover that nothing but blood flowed from puncture of its centre, did not dare to remove it, but immediately closed the wound, and the patient was also cured. Mr. Galenzowski of Wilna discovering that the tumor was too adherent to be removed, emptied it by a large orifice, tore down its different cells, passed a thread through its deeper wall, drew it towards the wound, to prevent all effusion into the peritoneum, closed in the best manner he could the division of the abdominal parietes, and obtained by this means an entire cure in the course of several weeks. Other attempts have been less fortunate.

A woman forty years old, treated the 20th September 1822 by Dr. McDowell, died on the morning of the 24th. Dr. A. Smith, arrested by intimate and very extensive adhesions of an ovarian tumor in a patient who had tapped herself more than twenty-four times, confined himself to incision of the parietes of the abdomen, and did not venture to finish his operation. He had however the misfortune to see this woman die on the forty-second day. The patient operated upon by Mr. Lizars on the 22d March 1825, died the next day. The one operated upon by M. Hopper and Chrysmer survived only thirty-six hours. Another by M. Chrysmer alone was not more fortunate. Lastly, the young woman whose case is given by M. Martini also died after thirty-six hours. Although dangerous, extirpation of the ovary does not the less constitute a resource worthy of examination. The ovary is not so indispensable to the support of life but that the woman may be deprived of it without too much danger. The gelders of beasts, who travel round the country exercising their profession, remove them without the least fear in the first

weeks from all the female pigs, and I can affirm that in their hands the operation is seldom followed by bad results. Diemerbroech, relates, from Athenaeus, that Adrametes, and from Suidas, that Gyges king of Syria thus treated the women of their kingdom. Alexander ab Alexandro says the same of the Creophagi and the Egyptians. Wierus relates, that a gelder suspecting the virtue of his daughter opened her abdomen, drew out the uterus to excise the ovaries, and that this barbarous operation had full success. Franckenau, Pott, Lassus, M. Deneux cite each a case of extirpation of the ovary which did not prevent the woman from doing well afterwards. The operation is of itself neither delicate nor difficult. The occasions of performing it are but two frequent. The diseases which require it if left to the resources of the system, almost constantly cause death. But for it to offer a chance of success, the tumor should be movable, not adhering to the intestines, easily separable from all the abdominal organs, with a root or pedicle not too large, and not exposing too many large vessels to be wounded. Moreover it must be known and distinguished from every other disease, which is far from being always easy. At first how are we to avoid confounding it with any tumor whatever adjoining the uterus, the iliac fossæ, &c.? Besides, who will then be bold enough to propose the operation? Later, when it occupies a great part of the abdomen, the new relations contracted by the organs surrounding it and the almost inevitable adhesions of its periphery, render its dissection and removal if not impossible at least extremely dangerous. In fine, although incurable from its nature, it ordinarily brings on death but very slowly. As a medium term it allows, not as Mr Corbin believes twelve years, but five or six to women affected with it. However, if as it generally happens in this case the general health is preserved in a manner to contrast with the diseased condition of the abdomen, if the issue of an unctuous or gelatinous fluid obtained by an exploring puncture, demonstrates that the disease is in the ovary, if the tumor does not exceed in size the head of an adult, and if the patient desires it earnestly, we should attempt the operation. It only remains to be determined if simple incision according to the principles laid down in the preceding article, with which M. Portal, Denman, Ray, and Ransden, are said to have been successful, ought not to be preferred to extirpation.

Manual.—Laid on her back, the pelvis members moderately extended and fixed by assistants, the woman ought to be placed so that the most prominent part of the cyst may naturally present to the operator. He first makes an incision parallel with the axis of the body, four, six, or eight inches long, on the most proper part of the abdomen, using the index finger of the left hand to direct the bistoury as soon as the peritoneum is opened, and then engages with the tumor. Is it free, movable, easily insulated, and its pedicle narrow, the surgeon has only to tie its root firmly, and excise it outside of the ligature with the bistoury or scissors. Are the adhesions uniting it with the surrounding tissues small and easily destroyed, he removes them by careful dissection, and acts as to the rest as in the former case. If it be fungous, with a broad base, with large blood vessels, it will be better not to touch it, but to close the wound. If the adhesions to the parietes of the abdomen do not permit its removal, we should plunge a bistoury into it and open it largely, so as to empty it entirely, and act so that the cyst may be gradually drawn through the wound of the abdomen. Position, adhesive plasters, or the suture should

be employed, according to the case, to unite the division; which should in other respects be dressed as simply as possible. When the solution of continuity is very extensive, the intestines have such a tendency to escape that the suture is then quite indispensable. It is nearly the same when in the removal of the tumor it was not necessary to open n r to occasion a great waste in the interior of the abdomen. It is quite the reverse when the cyst only is opened, or when it has not been possible to remove all that it had been intended to destroy. Supposing that we wished to confine ourselves to incision, we must first guard against effusion, and produce in the first place protecting adhesions, if they do not already exist, between the morbid mass and the parietes of the abdomen; and act in short as for an abdominal abscess or a hepatic collection.

SECTION II.

Hernia.

A. HERNIA IN GENERAL.

Art. 1.—*Radical Cure.*

Whatever be the seat of hernia, it forms always an infirmity if not a disease so troublesome, as to require our efforts not only to palliate but to permanently cure it.

The strange idea of the ancients in ranking it among the shameful disorders, an idea still entertained in such a manner that the resident in the country often opposes secretly the symptoms to which it gives rise, rather than complain to a physician, presented a bait too tempting not to be turned by empyricism to the best advantage. Thus in the days of Hippocrates, Galen, and Celsus, and in the present, were there pretended curers, *herniary* physicians, occupied singly with the treatment of this disorder. It would be unjust however to blame without exception the numerous attempts that have been made to obtain a permanent cure, even since the art possessed excellent means of retaining it. Laborers, who are the most generally affected with it, derive but little advantage from palliatives. The most perfect bandages are far from producing for them the success obtained to persons of a higher class. The cushion leaves the ring nearly always after several days or weeks, and often the whole of the truss soon proves a new source of danger.

§ 1. *Topical Remedies, Compression, Position.*

The *emplastrum contra rupturam* of the ancients, the brick cerate of J. Fabricius, Verduc's vinegar bags, sandal wood, tormentilla, turpentine, the topical applications of Babynet and Mdlle. Devaux; the famous remedy of the prior of Cabriere, which consists in red wine being applied to the hernia, and muriatic acid taken internally, the cataplasm of iron filings, while loadstone is taken internally, advised by A. Pare; the decoction of *dogs'-grass* and of *were-wolf* used by Arnaud; the carbonate of ammonia mentioned by M. Belmas, and a thousand other means of the same description, at present

find no defenders except among quacks and old women. It is otherwise with compression, recommended by Celsus, Norsia, Blegny, Trecourt, J. L. Petit, Juville, &c. Maintained with perseverance, and properly applied, it has frequently produced a definitive cure without requiring to be raised to the point of determining gangrene as was advised in Germany more than half a century since. Quite recently M. Beaumont, in a particular treatise, and M. Duplat of Lyons, in a memoir addressed to the academy, have endeavored to reinstate it in the good opinion of practitioners, by maintaining that combined with astringents it can cure nearly every hernia. A surgeon of Provence, M. Ravin, states also as a certainty, that topical astringents and compression can radically cure hernia at every age. These means with him however are only secondary, the foundation of his method being the horizontal position of his patient for whole months. The observations of Riviere, F. de Hilden, Reneaume, Arnaud, and Hey, and the thesis of Rieck, show all the benefit to be derived from the treatment proposed by M. Ravin—a treatment which is said to have been generally used in Denmark in the time of Winslow; but besides the uncertainty of success, what patient would consent to remain in bed six months or a year for a tumor which is so easy to retain by means of a simple bandage? The examination of these various resources belonging properly to pathology, I can only give them a passing notice, without pretending to fix their value or disadvantages.

§ 2. *Various Operations.*

The principal operations which have been put in practice for obtaining the radical cure of ruptures, are cauterization, the ligature, the suture, incision, excision, scarifications, dilatations, and closing of the ring.

1. *Cauterization.*—If it were sufficient in order to cause an operation to be proscribed, to point out its dangers and cruelty, and demonstrate its inutility, cauterization so frequently employed in the times of Albucasis, Roger, and Guy de Chauliac, had not been extolled by so many practitioners at different epochs. But by denying the success it has really procured, in holding as nought whatever of advantage it may offer, its antagonists have more than once given the victory to those who were endeavoring to spread its practice. Avicenna speaks of surgeons who laid bare the hernia, raised up its internal envelope without opening it, and cauterized deeply the ring with red hot iron. Others, Franco for example, opened the sac and merely touched its neck with fire. A number of chymical caustics have been employed for the same purpose. The escharotic oil, mentioned by J. Fabricius; the sulphuric acid of the empiric Littleton, and which another quack found means to propagate in Paris in the time of Arnaud; the muriate of antimony, potassa, essence of euphorbia, ranunculi, &c., have each in turn been tried. It was with the oil of vitriol that Maget, supported by Gauthier, soon after unmasked by Bordenave in the academy, obtained in 1773 the pretended cures which induced him to solicit the favor of government, and which caused the death of the celebrated Condamine. The potential cautery was applied on the skin in the form of a train, or on a circumscribed point towards the neck of the hernia, for the purpose of there producing an eschar, and causing the sac to suppurate after perforating it. It appears however that Monro and the naval

surgeon spoken of by Sabatier, applied their escharotic also to the interior of the sac. Thus considered, cauterization includes two quite distinct methods, one which relates to the herniary tunics, the other which attacks on the contrary the orifice through which the organs are displaced. The first has the disadvantage of being liable not to penetrate sufficiently deep at first, or in the opposite case, of injuring the intestine itself; the inflammation it determines cannot be limited to the sac, may reach the peritoneum, and thus cause the death of the patient. The second, which is not more entirely free from this last danger, offers at least the resource of saving with more certainty the viscera, since the operator commences by exposing them and pushing them back into the abdomen. It must be added that this alone offers any chance of success. It is in this way, when the eschar formed at the opening of a hernia has been occasioned by actual cautery or any chemical substance, it leaves, as a consequence, an ulceration which can be cauterized only by the second intention. But as every cicatrix which is not the effect of an immediate coaptation of the tissues, is soon converted into a firm and elastic layer, it is readily understood what kind of barrier may be opposed to the reproduction of hernia; whereas the method which may be termed mediate, admitting even the most complete success, will have no other effect than the closure or obliteration of the sac.

2. *Ligature.*—The manner of applying a ligature around hernias when radical cure is intended, is by no means the same with all authors. Some apply it immediately on the sac, others on the skin without any previous incision. Pare saw some who made a circular incision, at the bottom of which they tied a thread. Since the time of Paul many practitioners had also recourse to the furrow, but many of them afterwards opened the whole sac to be certain that no organ was included in the ligature. Guy de Chauliac says, that the sac is first to be laid bare, in order to be seized and strangulated more surely at its base. Among those who were content with the mediate ligature, there were some, like Thevenin, who traversed the whole pouch with a double thread and tied its two halves separately. J. L. Petit, who has slightly modified this process, pretends to have derived great advantages therefrom. Others, mentioned by Celsus, placed the integuments between two plates of wood, and compressed them as with pincers until they became gangrenous. In fine, the oldest process, that adopted by Saviard and Desault, consists in tying circularly the neck of all the herniary envelopes so as to produce mortification more or less promptly. This method, less barbarous and terrible than cautery, has evidently had a certain degree of success. If Lassus had better understood its mechanism, he would not have called in question the instances given by Bichat, from the practice of Desault. There is every reason to suppose that the medical societies of Lyons and Paris would not so formally have proscribed it in 1812, when M. Martin addressed to them his work with a view to revive it, if they had fixed their attention on the nature of the inodular tissue, which ulceration produced by the thread leaves in its course. No doubt, after the destruction of the integuments, it forms in front of the ring a cicatrix so firm as to render the escape of the viscera very difficult, and thus affords some chance of a complete cure. However, as it does not fail to be very painful at times, to create danger of peritonitis, and pinch some portion of the viscera, unless very great attention has been given to it, and

as on the other hand, umbilical hernia of infancy, to which it is peculiarly applicable, is often cured without any assistance, or under the influence of a simple bandage, this operation scarcely deserves to be recalled from the oblivion into which it is fallen, and the success recently obtained from it by M. Bal, does not more enhance its value than the constant success which it is said to have upon colts.

3. *Suture.* The suture which is limited to sewing up the sac after it has been incised, or simply emptied, is at first much more dangerous than the ligature as practised by Desault, since it requires a dissection sometimes very tedious before it can be effected—and then does not necessarily cause the formation of an elastic cicatrix, since it is not accompanied with loss of substance, and has no other end than the obliteration of the sac—it is evident that it must have less efficacy than the first against the return of the disease. Besides it is not a general method; it belongs specially to inguinal hernia in men the same as castration, consequently it is unnecessary for me to dwell longer upon it at present.

4. *Incision.* Incision has been long considered as an excellent means for the radical cure of ruptures. It is only since the beginning of the last century that surgeons have abandoned it. All the tunics and the sac itself were divided as for strangulated hernia. The viscera being reduced, the dressings were applied, and the wound brought to cicatrization as in the last case. The obliteration of the sac was to be the result of the manœuvre, and the operator hoped by this to render the patient secure against all further escape of the intestines from the abdomen. Practitioners soon discovered that the question had not been presented in its proper light. J. L. Petit, yielding to the advice of Arnaud against his own conviction afterwards seriously repented it. One of his patients died on the fifth day. He was witness of another similar case, and it was only after running the greatest risk that a third was restored to health. Acrel, Sharp, Richter, Abernethy, &c., in pointing out the same dangers, have also shown that incision of hernia is of itself much more formidable than Lieutaud and Leblanc imagine. Huermann and a great number of other practitioners after him, having remarked on the other hand that it does not even succeed in preventing a return of the disease, that persons operated upon for strangulated hernia are nevertheless obliged to wear a truss, it is not astonishing that they have banished this surgical resource from practice.

5. *Excision.* If incision could not be retained in practice, with much more reason should excision be proscribed. We cannot in truth dissect, insulate, and remove the sac after opening it, as Bertrandi advises, without increasing still more the difficulties of herniotomy. In merely excising opposite the ring, a disk including the whole thickness of the envelopes of the tumor previously reduced, as also directed by Lanfranc, we may equally produce peritonites and moreover wound the viscera if they adhere to the interior of the sac. The excision of the whole herniary sac, it is plain, would be attended with still greater dangers. It is truly painful to find the detail of operations of this kind in the works of Arnaud, Schmucker, and other more modern surgeons.

6. *Dilatation.—Scarifications.* Instead of excising the sac, after incising it largely, Leblanc conceived the idea of applying to the radical cure of hernia dilitation of the ring, already praised by the older surgeons, but particularly by

Arnaud, for removing the stricture. Such a design if ever seriously proposed would refute itself. The idea of scarifying the ring, an idea which is referred to Leonidas, is less strange; and Richter did not perhaps feel the full value of his assertion when he said that *small incisions* increase greatly the adhesions which naturally follow the operation. The effusion of lymph which is almost the necessary result, procures effectually the chance of seeing all the tissues mingle at the opening of the sac, and the ring definitively closed. If J. L. Petit and Heister had made this remark, they could not certainly have maintained that scarifications are more proper to relax than to strengthen the canal or hernial opening. It is evidently to the same omission that must be attributed the contempt of Lassus for this process, and the silence on this subject of the greater part of modern authors. The principal reproach that attaches to it is its presenting the same dangers as incision, of which after all it is but a simple modification. As to the chances of success, it is assuredly one of those which offer the most. In this respect it is therefore as worthy and even more worthy of attracting attention than any other.

7. *Dr. Jameson's method.* The radical cure of hernia has always been sought for with such avidity by patients, that the need of obtaining it has never ceased to torment surgeons, and in our days many means are still proposed for this end. That of Dr. Jameson of Baltimore deserves particular mention, as much on account of its originality as of its real importance. A woman operated upon with success by this surgeon for strangulated hernia, being much troubled at seeing her disease return after several months, complained to him and desired to be freed from it at any cost. The hernia was crural. Having exposed the ring, Dr. Jameson cut, at the expence of the neighboring integuments, a lancet shaped flap, two inches long and ten lines wide, having its root on the side of the first wound, carefully dissecting it, to invert and introduce its floating portion into the hernial opening; fixed it in this place by uniting the solution of continuity which he had just made by several stitches, and supported the whole with an appropriate bandage. The patient was completely cured, and there is every reason to believe that the stopper engaged in the crural canal became engrafted there as in rhinoplasmus, &c. At first view we discover nothing but what is ingenious in the method, and can comprehend all its elements. If on the one part, it is more complicated, more painful, and at least as dangerous as incision and scarification, on the other it seems capable of giving much more certain results, since by this means we are sure of entirely preventing the egress of the viscera. However, to appreciate its value from a thorough knowledge of the case, facts are necessary, and science as yet possesses but the one. I will even add that this case has not all desirable authenticity; that we can scarcely understand how, through respect for the wishes of his patient, Dr. Jameson could have consented to have but a chambermaid for assistant and witness of the operation. So much mystery would be capable of raising doubts in the mind of the least suspicious reader.

8. *Method of M. Belmas.* More recently, in 1829, and by a chain of ideas with which I have nothing to do here, M. Belmas arrived at the invention of a new method, which seems to him easier, more certain, and less dangerous than all others. He directs a small pouch of goldbeater's skin filled with air to be carried in and fixed to the superior part of the hernial sac. The plastic

matter which is not long in being effused, penetrates the parietes of this foreign body and in some measure combines with it. The whole becomes organized, contracts adhesions with the ring or the neck of the sac, is transformed by degrees into a solid lump, and in the end opposes an almost insurmountable barrier to the viscera. Numerous experiments upon dogs, support the assertions of M. Belmas. It remained to make application of it upon man; which first took place upon M. Plessys, a gentleman fifty-four years old who had had an inguinal entero-epiplocele for about thirty-four years. The operation performed by M. Belmas was followed by no accident but by perfect success. Encouraged by so splendid a result the author communicated his process to M. Dupuytren, requesting him to try it on a lad fourteen years old who was then at Hotel-Dieu for a congenital hernia combined with hydrocele. Various incidents rendered the operation long and fatiguing. Alarming symptoms followed and caused much apprehension for ten days, so as to induce M. Belmas to have the patient removed to his own house that he might watch him the better. However his health was gradually restored, and towards the end of the second month the hernia as well as the hydrocele were radically cured. A third attempt, made by M. Belmas assisted by M. Jaquemin at the Madelonettes, on a prostitute affected with syphilis and umbilical hernia, was not so regular as to allow any strict conclusion to be drawn from it. A solid and permanent cure was nevertheless the consequence of this attempt, in other respects so incomplete. In a fourth subject fifty-seven years old afflicted with a hydro-sarcocele, M. Belmas wished to see if his method would succeed at least in closing the ring and curing the hydrocele. The pouch became solidified about the summit of the tunica vaginalis which was inflamed, and which it was necessary to empty of a sero purulent matter with which the inflammation had filled it. In fine, a fifth trial was made by myself, assisted by M. Belmas at La Pitie, in the month of November 1830, upon a man about sixty years old, who had had two inguinal hernias for a long time, and who at his entrance into the hospital showed some symptoms of strangulation, and died in consequence of gangrenous erysipelas. But various circumstances unnecessary to relate at present are sufficient to cause this essay not to be reckoned. The first of these cases seems to confirm all the hopes of M. Belmas. The fourth, that of hydro-sarcocele has, in my opinion but little value with respect to the principal question, and hardly deserves to be noticed. The other three alone truly complicate this problem; still it must be confessed that one of them, that of the prostitute, of itself proves nothing for or against the method. The child operated on by M. Dupuytren, seems to have been seized with inflammation of the gastro-intestinal passages and not peritonitis. In the case which I observed, very strange symptoms were manifested, and the material remote cause of death was the gangrenous phlegmasia of the scrotum. It is not clear that the symptoms met with in these two patients were to be referred more to the operation in question than to any other. The most trifling puncture has sometimes produced them, and it is not rare to see them occur spontaneously. The accident to be apprehended in the process of M. Belmas is peritonitis; but this phlegmasia was not observed in the patient who died under my care, and I do not perceive that it existed in the little patient of M. Dupuytren. The natural conclusion to be drawn from all this is, that in such a condition a puncture or incision would probably have

produced the same fatal results, and that in reality these facts are by no means conclusive against the idea of M. Belmas, if in other respects it has sufficient foundation. This last question brings us naturally to consider the absolute and relative value of the various methods we have already discussed.

§ 3. *Is it possible to obtain a permanent Cure of Hernia, and ought it to be attempted?*

After having long believed in the efficacy of the thousand means successively boasted of as producing it, the profession has arrived at the conclusion that the radical cure of hernia is almost impossible. The openings through which the viscera escape, being surrounded with bone or fibrous bands have not, it is said, any tendency of themselves to close; and the mind does not in the first place perceive how the operations proposed could determine their obliteration. Besides, what is indicated by theory has often been confirmed by experience, for every body agrees that the operation for strangulated hernia does not relieve the patient from the necessity of wearing a bandage, if he would prevent a relapse. It remains to know if in both these respects we are not imposed on by prejudice. If it is true that herniotomy does not always prevent a return of the disorder, it cannot be denied that it does so sometimes, and even very frequently. I could cite many examples; among others, that of a young student of medicine upon whom I operated in 1827; a second more remarkable, inasmuch as it concerns a man thirty years old affected with congenital hernia, upon whom also I operated in 1824, at the hospital of Improvement; and a third of an adult with an entero-epiplocele of several years' standing, on whom Dr. Payen operated in my presence about the beginning of 1831. The operation for hernia leaves a wound which almost necessarily suppurates, and the whole extent of which must be covered with cellular granulations as far as the ring. Hence results a new tissue; the base of the cicatrix, which, by its great elasticity and the adhesions which it contracts with the surrounding parts, will certainly tend to close solidly the hernial passage. To understand the whole action of the cicatrices in this case, it is sufficient to call to mind the displacement caused by those usually produced by burns, variola, &c. But to arrive at this result the wound must suppurate—its union must not be immediate; in a word, the whole surface of the sac and the interior even of its neck must have time to form cellulo-vascular papillæ. If the art has the power of radically curing certain hernias, the means of arriving at it is to close their passage by an inodular cicatrix. Cauterization is evidently calculated to produce it; for example, when it acts on the whole substance of the scrotal tunics and reaches the internal face of the neck of the sac. Ligature, mediate or immediate, offers less certainty, because it acts only from without inwards, and under its influence the interior of the ring may remain free from all morbid action. The loss of substance from excision is a guaranty of success which cannot but be appreciated. Even simple incision no doubt frequently succeeds, if we are content to close the wound by the second intention. Scarification must excel all other processes; first, because it does not expose the chord to lesion as much as cauterization, nor the vessels, as excision; and then because it is followed with a cicatrix much more firm than incision strictly so called, to which it adds scarcely any

difficulty and complication. As to Dr. Jameson's method, if new cures should confirm what has been said by its inventor I would consider it preferable to every other. The tegumentary stopper which he places in the ring, would admirably supply the place of the strongest cicatrix, at the same time allowing the immediate union of the wound. That of M. Belmas would probably do equally well if inflammation and suppuration of the whole surface of the sac did not often complicate it, and sometimes render it dangerous. Until experience has more amply tested the value of the two last methods, I would accord the preference to scarifications in an attempt at a radical cure of hernia.

As a possible result I do not think that this cure can hereafter be contested. The only question is, at what price can it be obtained? In itself the operation is in reality neither difficult nor very delicate. Injury of the testicle, the chord, the vessels, and the various local symptoms it may bring on, are not inevitable. General symptoms and peritonitis, which have more than once been the consequence, constitute therefore its principal dangers; but will the few cases related by J. L. Petit, Richter, Abernethy, &c., suffice to settle this question. The removal of a cancer, the operation for congenital hydrocele, have also caused death, and still no one concludes it necessary to proscribe these operations, although applied to less serious disorders than hernia. Who will pretend to say that accidents, sometimes so serious, produced by phlebotomy, should be a cause for rejecting bloodletting? Is there a single operation, even a simple puncture, which may not become fatal under more than one combination of circumstances? If such *possibilities* always stopped the surgeon, would he ever have occasion to open a bistoury or empty an abscess? For myself, I eannot see that up to this time, observation has decided on this subject without appeal. On the contrary, I am disposed to think that, justly intimidated by fatal exceptions or inexplicable coincidences, modern surgeons have been biased in the examination of so important a remedy, and that it deserves to be subjected to new trials before it should be entirely renounced. But supposing a desire to attempt the radical cure of hernia, it must not be supposed to be applicable to all cases without distinction. In youth it offers less danger and greater chance of success. The two extremes of life are less favorable, on account of indocility of children and the rigidity of the tissues in advanced life. Old, voluminous, and irreducible hernias, complicated with extensive adhesions, are generally ill-adapted to it. Nevertheless, it may be employed with advantage if the enterocele and epiplocele are kept in the bottom of the sac only by a band that may be easily divided with a cutting instrument. It is clearly indicated, for example, when in a congenital hernia filamentous adhesions expose the testicle to painful tensions, and to being drawn towards the ring whenever the viscera return or reduction is attempted. The risk run by Zimmermann after this operation, was probably owing to the difficulties experienced by the surgeon rather than to the operation itself, and is of no weight against it. In fine, herniotomy will succeed best with adults or persons approaching the adult state in enteroceles, free from adhesions, of small size, and of recent occurrence. When the operation is to be performed, the patient is to be treated and placed as for removing a strangulation, whatever in other respects be the method adopted.

§ 4. *Inguinal Hernia.*

Besides the preceding methods, which are applicable to it in common with every other kind of hernia, inguinal hernia has caused the invention of a great number of others which can only be mentioned in discussing it particularly; such are in particular castration, the golden stitch, and the royal suture.

1. *Castration.* Some advocates of excision, of the ligature or compression of the sac, finding dissection of the peritoneal elongation too difficult, cut the knot, by including the spermatic chord and the sac in the same ligature. Hence arose castration. To perform it, Paul directs a T incision to be made on the anterior face of the scrotum. The transverse wound serves for applying the ligature, the other permits the extirpation of the testicle. There are some who with Franco laid bare the genital gland at its inferior part, dissected the chord and sac from below upwards, tied the whole near the ring and cut it below the ligature. In the last century some constricted the chord and sac separately before excising them. Others went so far as to include the chord, the sac, and the scrotum in the same ligature. This criminal operation, practised with a sort of mania by the old surgeons, is now forbidden by our laws. To suppress the custom in his states, Constantine was obliged to attach to it the penalty of death. Dionis speaks of a charlatan who fed his dog with testicles removed in this manner. In 1710, Housse was sent to the galleys for the same act. Castration was performed not only to cure, but to prevent hernia. With this idea thousands of children have been mutilated. Women themselves had the temerity to undertake it. M. A. Prosse was whipped in 1735 at Rheims for similar misdeeds. Since that period, in the same diocese, there was a wretch who boasted she had performed it on more than five hundred subjects. Some of our provinces have been the theatre of similar scandalous acts within a few years past. To explain how it happens that even at this time certain beings outrage morality and the laws by practising this operation would not be very easy. I am not sure however if the fault is not as much with the surgeons as with the public. To do it away, gentlemen of the profession have represented castration in such cases as excessively dangerous, and capable of frequently producing death. On the other hand, according to them, it never produces a permanent cure, and is always useless; but there is in these assertions an exaggeration which overshoots the mark. The attentive perusal of the old authors proves that the immense majority of patients who submitted to it did very well, and that many of them were thus freed of their hernia. The mass of the community renounce these errors and their prejudices only when clear and defined truths are offered in their stead, and not when an attempt is made to oppose them by other errors. We must not hope to do away castration by maintaining that it is fatal and seldom succeeds, but by speaking truly and showing the people that it is frequently dangerous, that it does not always succeed, and that it deprives man of an important organ, and that it may be advantageously supplied by an operation unattended with these inconveniences. The only cases which permit its application are those of sarcocele and an incurable degeneration of the testicle coincident with bubonocele. Notwithstanding what Sharp says, I do not see how adhesions, whether epiploic or intestinal can require it, when at the time of celotomy they prevent the reduction of the displaced viscera. At the moment

of terminating an operation of strangulated hernia, it is not sufficient that the testicle be a little more or less in size than usual, that it *appear* a little diseased, but it should be extensively altered for a surgeon worthy of the name to decide on its removal; and it was not without extreme surprise that I found recorded in the most recent work of one of our great masters, two cases of quite an opposite character.

2. *Point Dore.*—A process, traced as far back as Oribasius, which was intended to avoid the loss of the testicle, and at the same time produce the effects of castration, is the golden stitch. It consists in passing a gold wire around the chord and the sac, and then applying compression in such a manner that only the latter shall be constricted; and then uniting the wound without regard to the presence of the foreign body, which the patient is to wear during the remainder of his life. This method was used in Denmark by Buchwall, and in France by Berrault. It is not described precisely in the same manner by A. Pare, who directs a wire of lead instead of gold, and that it be removed after a certain period. The absurdity of such a practice is sufficiently striking without any comment. Every one perceives at first sight that a ligature so applied cannot save the chord more than the sac, and that it will oftener produce atrophy of the testicle than the cure of the bubonocele.

3. *Royal Suture.* The suture called *royal,* because according to J. Fabricius its intention is to preserve to kings useful subjects, is far from deserving the same reproach as the point dore. To perform it, the ancients first dissected the sac, insulated it from the surrounding tissues, and then sewed it for its whole length without touching the chord. This appears to have been the practice of the Turks at the period when Cantemer wrote his History of the Ottoman Empire. But Sharp thought to improve it by proposing to sew at the same time the sac and the integuments near the ring. In any way it is seen not to require the sacrifice of the testicle, and that it must offer greater probability of success than the golden ligature. However, as this is in reality but the suture applied to scrotal hernia, and as scarifications have in this place the same advantages as elsewhere, I will not dwell longer on the importance of the royal suture.

Art. 2.—Strangulated Hernia.

Hernia is sometimes complicated with accidents which render it one of the most serious disorders, and one of which operative surgery possesses the sole remedy. Obstruction and strangulation, the most formidable of these accidents, deserve for this reason all the attention of the surgeon. A hernia is said to be obstructed when the substances destined to escape by the anus are arrested in the intestinal fold which forms it, so as to interrupt in this place the passage of substances whose course is through the digestive tube. Strangulation is constituted by mechanical constriction exerted by the surrounding tissues from without inwards upon a portion of the alimentary canal, so as to efface more or less completely its calibre, and powerfully disturb its principal functions. From this definition, it is perceived that strictly considered there may be obstruction without strangulation, and *vice versa.* Nevertheless, as obstruction seldom becomes dangerous but from the strangulation which soon

takes place, I see no disadvantage in following the course adopted by many authors, who consider these two accidents but as the cause and effect of each other, and only treat of strangulation. In fact, strangulation may be brought on by various causes without any change in its nature. It sometimes is effected slowly, at others suddenly; it is of various degrees, is attended or not with inflammation, but it is not the less strangulation. The term *incarceration*, which Scarpa employs for cases in which the intestine is only distended in the hernia without being materially injured, seems to me to be of no advantage. Words are of little importance, provided they give a clear idea of the thing. Its mechanism is of two kinds; a fibrous opening of the abdominal parietes may yield and dilate at a particular time from some effort of the subject, and allow a portion of the viscera to escape, and by virtue of its elasticity contract again so as to produce a violent constriction on the organ just passed through. In this case there is a strangulation by *reaction* of the *herniary passage*. In other cases the contained parts swell and become distended more or less promptly, and by this eccentric movement are not long in producing strangulation, which in this case occurs from *reaction* of the *incarcerated* organs. The first generally appearing suddenly, sometimes with the hernia, or by the addition of a new portion of viscus in the containing sac, being rapidly followed by inflammation, has received the name of *acute* or *inflammatory* strangulation. The second being developed only by degrees, except in hernias, which are not habitually reduced, exciting inflammation only after considerable lapse of time, constitutes the SLOW strangulation, or strangulation from *obstruction;* which, however, does not absolutely prevent its being manifested at times with great suddenness. It is sufficient to remark that the openings through which hernias are produced are entirely fibrous, and consequently deprived of any contractile property to show that spasmodic strangulation imagined by Richter and some others is really impossible. Fages of Montpelier, who, according to M. Delmas, continued to admit it, attempted in justification of his opinion to transfer this pretended spasm to the large muscles of the abdomen, which would then react on the hernia by giving more rigidity and tension to the aponeurotic bands. But in the mind of any one who understands the anatomy of the abdomen, such an idea refutes itself, and does not require to be opposed. However this may be, strangulation may act on various organs and have its seat in very different places, a circumstance not well understood, and from which no advantage can be drawn in the treatment unless we remember exactly the composition of hernias.

§ 1. *Anatomical Remarks.*

Every hernia offers two things for consideration, its envelopes and the viscera which constitute it.

1. *Viscera.* There is no organ within the abdomen which may not possibly form a hernia; all, however, are not equally likely to strangulation. Thus the bladder, the ovaries, the uterus, the spleen, and the liver have been seen together or separately in a hernial tumor. But with the exception of the urinary reservoir, it can scarcely be conceived how these various organs are liable to strangulation. The intestine, a large canal continually giving pas-

sage to abundance of substances, must on the contrary when its calibre is effaced, when it becomes impermeable in some point of its length, disturb the whole economy and give rise to numerous distressing symptoms. A constriction of the epiploon it is true does not explain so well these phenomena; but whether it depends on tractions exercised upon the stomach and large intestine, or on a sympathetic reaction transmitted by the trisplanchnic nerve, experience proves that they may then be manifested and they must be admitted. In order not to confound these parts with each other it is important never to forget their principal characteristics. The spleen, blacker, softer, and more easily torn if its membrane is broken, than the liver, may be distinguished from it besides by the yellowish tint and granulated appearance of the latter. The small intestine differs from the large in its size and the regularity of its external face. Its fullness and the absence of folds and muscular bands in the stomach do not allow it to be confounded with the one or the other. The fatty appendices of the colon differ too much from the spreading form of the epiploon, to be mistaken. As for the epiploon itself, as it may lose its membraniform condition, after remaining some time out of the abdomen, and the adipose flakes which are often found on the external face of the peritoneum, and sometimes acquire sufficient size to simulate hernia, may, if we be not on our guard, lead unto error on this point. However, unless there are morbid adhesions the embarrassment of the practitioner will not last long, if he call to mind that the omentum is prolonged into the belly while the purely adipose lumps have their origin without that cavity. The blood vessels of each organ have here some interest. In the intestine they form arches, arborizations, and fern-leaf expansions in the bladder, and also in the cœcum simple *divergent arborizations without very evident arches.* Those of the peritoneum and its cellular lining spread into stars by layers and in a very irregular manner. In the epiploon their volume is enormous in comparison to the thickness of the lamellæ through which they pass, and at a certain distance apart they are observed following a direction parallel with each other. In the mesentery, certain venous branches sometimes increase so much in size as to occasion serious hemorrhage if they happen to be opened, a remarkable example of which is related by Scarpa; but we shall have to return to this subject hereafter.

2. *Envelopes.*—The envelopes of every hernia contain, as essential elements, the integuments, the peritoneal sac, and the intermediate layers. The skin presents nothing remarkable, except in regard to varietes of thickness, density, and adhesions. With the sac it is quite otherwise.

a. *Sac.*—The name of sac is given to that portion of the peritoneum drawn by the viscera out of the abdomen, and which forms the most immediate covering of the hernia. The older writers had only confused ideas on this subject. They imagined that *descents* or *hargnes* (hernias), which they also called for this reason *ruptures* or *breaks*, took place through a rent in the peritoneum. At the time of Dionis it is true the case was otherwise, and the existence of the hernial sac was admitted in the majority of cases, at least it was not rejected, except in certain special hernias, the umbilical for example; but it is only since Mauchart and Arnaud, since the middle of the last century, since the academy of surgery, that it has been regarded as an essential part of every kind of hernia; so that its presence is now universally admitted. I

mistake, the moderns agree that hernias, in consequence of penetrating wounds of the abdomen, the Cæsarian operation, ligature of the iliac arteries, and gastrotomy, are usually without it. When the bladder is displaced in its anterior face, or the cœcum in its adherent face, there is no hernial sac. This is a fact quite recently demonstrated by Mr. Calson in opposition to Scarpa, who has gone to a great length to prove the contrary. Let us remark however, under this last point of view, that it is more a dispute about words than a real difference of opinion. In maintaining that cœcal and vesical hernias have a sac, Scarpa only meant that a greater or less portion of the displaced organ is free within the tumor, and that there is found there a prolongation of the peritoneum as in ordinary hernia. Mr. Colson does not think of denying this disposition; he only contends, that the hernia being adherent by the greater part of its surface the name of sac cannot be given to that portion of peritoneum that covers the rest. Some again believe that hernias caused by traumatic lesions of the abdomen have a sac like the others unless they occur before the complete cicatrization of the wound of the peritoneum. This is a question which appears not to have been presented in its proper light. When a penetrating wound is closed and healed, there ordinarily results a cicatrix less thick and less firm than the natural parietes of the abdomen. This is explained not by saying that the two lips of the wound of the peritoneum are not united, but that instead of muscle and aponeurosis there is in this place but a fibro-cellular tissue of new formation. If therefore a hernia is formed through it, whether it push the cicatrix before it or merely displaces by passing through it, it is not perceived how it can fail of being surrounded on all sides with peritoneum, and of thus having a real sac. But this cicatrix may in some measure remain independent of the serous abdominal layer, as it is possible that the peritoneum may be so adherent to the margin of the opening which gives passage to the viscera, that the hernia shall receive no sac from it. What takes place in this case is also observed at the umbilicus. I am positively assured from dissection that in general exomphalos has no internal tunic which may be separated from the other envelopes. The smooth layer that has been taken for it is intimately connected with the external tissues, and is developed by dilatation like that formed in cyst, usually filled with diaphanous or synovial fluid, and not by displacement or elongation of the peritoneum. These remarks bring me to admit, 1st, a *true* sac, or sac by transfer of the peritoneum; 2d, a *false* sac from simple distention of this membrane, or any other form of cellular tissue; 3d, an *incomplete* sac for vesical and cœcal hernias, &c., that is to say, that the hernial pouch is covered entirely with a true serous *membrane* in the immense majority of cases, only partially in some others, and in the smallest number of cases a simple surface instead of a membrane is seen on its interior; as for instance, the uterine cavity presents but a mucous *surface*, while in the intestines there is a real *membrane* of this name.

The *form* and *volume* of the sac vary almost infinitely. Hemispherical, globular, pyriform, irregular, conical, cylindrical, wallet-shaped, with a double, triple, or guadruple neck, &c.—it may scarcely be larger than a hazel nut, or equal in size the head of an adult. Its internal face is polished and humid, and does not differ from that of serous membranes in general. Its external face demands a little more attention. In the true sac it is lined with a cellular layer which plays an important part in the history of hernia. This layer

is a portion of what I willingly call *fascia superficialis* interna, or the *fascia propria* of the peritoneum, and exists throughout, but with various degrees of laxity, thickness, and adhesions, over the different points of the abdominal cavity. It is this through which run the blood vessels generally attributed to the peritoneum, and which by its induration and gradual condensation produces what is called the thickening of the sac; and which having undergone a filamentous or semifibrous transformation gives origin to that knotty appearance and those inequalities on the external face of certain hernias, and which may also be the seat of inflammation, suppuration, and morbid alterations of every kind. It is from this also that most of the vessels come which terminate beneath the skin after passing through the muscles and aponeurosis, and that those small adipose masses arise which, passing little by little the vascular orifices of the fibrous and muscular layer and abdominal parietes, in the end sometimes make a projection beneath the skin, and are mistaken for real hernias. Around the false sac this layer intimately blended with the surrounding lamellæ, distinguishes it from the preceding, and makes instead of a *separable* membrane, a surface incapable of any motion; so that no adipose lumps, morbid deposits, nor infiltration of fluids can possibly be between it and the rest of the herniary coverings.

The name of *neck*, which is given to that portion of the sac which remains in the herniary opening, might be advantageously superseded by that of *root*; for the first brings with it the idea of *strangulation*, which is far from always existing, while the second, which is equivalent to the word *origin*, will express exactly the object in every case. However, as in operative surgery particularly the use of it can do no harm, I will continue to employ it. The neck of the sac there, and I mean of the true sac, is ordinarily narrower than the body and fundus of this pouch, and often puckered like a purse in the ring that contains it. If the hernia is of long standing, if they remain long in contact, it is easily conceived how these folds may agglutinate and give to the neck in question a considerable thickness and power of resistance, which in fact is very frequently observed. The presence of several necks in a single hernia, so well explained by Arnaud, and since by Pelletan and Scarpa, has nothing in it obscure or surprising to any one since the appearance of the works of M. J. Cloquet. If after having been long reduced a hernia should suddenly reappear, the neck of the first sack being too narrow to allow passage to the viscera would be pushed forward by them, at the same time that they carried along a new portion of peritoneum, and form a new neck. If the same thing happen a second, a third, and a fourth time, we shall have a sac with several necks. When the first adheres powerfully by a part of its body to the neighboring tissues, it is possible that the other only gives it a valve-like motion instead of making it descend directly before it. In this *wallet* the two pouches are in front or at one side, and not one below the other. The production of these necks is still possible without the hernia having returned. Then it is a new descent which forms above the old one. The adhesion of a chord or epiploic mass to the bottom of the primitive sac is most particularly favorable to the formation of a second neck. Pelletan cites a case in which the epiploon traversed in this way three contractions and fixed itself at the bottom of the lowest sac. I have seen one quite similar, another in which the superior sac enclosed also a coil of intestine, and yes-

terday at La Pitie, one which hardly differed from the first. As to the numerous necks of knotted sacs they are formed in quite another manner. These are simple hernias of the sac between the fibres of the *fascia propria*, or of any fibrous layer that may have taken its place. Instead of necks, the sac may be divided by real septa, and form one or more independent cysts below the portion which continues to enclose the viscera. The patient operated on after the manner of M. Belmas offered me a beautiful example.

b. Aponeuroses.—The tissues which separate the sac from the cutaneous covering necessarily vary with the seat of the hernia, and cannot be usefully studied but on occasions of each hernia in particular. I consequently shall only for the moment attend to the common cellular tissue—the *fascia superficialis*. When there are neither aponeuroses nor muscles interposed, the *fascia propria* and the fascia superficialis are finally blended in the thickness of the herniary pouch; that is, no separation between the cellular lining of the skin and that of the peritoneum is distinguished. Yet as, in its deepest part, it is lamellar, and not filamentous nor adipose as in approaching the dermis, it sometimes assumes the appearances of an aponeurosis which prevents this confusion. It is the seat of the subcutaneous veins and ganglions, and of the infiltrations, suppurations, and indurations which are consequent upon acute or chronic inflammation, and may grow to a surprising thickness even after allowing for the fat naturally found in it, and thus remove the hernia considerably from the exterior of the body.

b. Herniary Openings—.The openings which permit the formation of abdominal hernias are of several kinds. Some being accidental frayings, such as happen to individuals whose abdomens have been violently distended by pregnancy, ascites, a tumor of any sort, &c., very rarely give place to strangulation. The same remark applies in great measure to those resulting from penetrating wounds of the abdomen. There are others which are also not worth a long discussion. The orifices which are found here and there in the several fibrous layers of the oblique or transverse muscles for the passage of vessels of the third order are of this description, and offer besides this remarkable fact, that the masses or fatty tumors, the pedicle of which they surround, which enlarge beneath the skin, and adhere besides to the peritoneum, may dilate them and drag through by degrees a portion of that membrane in the form of a sac or the finger of a glove, in which the intestine may in turn be lodged and even strangulated, and constitute a species of hernia very embarrassing to a practitioner who had had no previous notion of it. Those of which it remains for us to speak, may be referred to two orders: these are simple openings which are called *rings;* and passages of greater or less length, more or less oblique, and generally known at present under the name of *canals*. At the umbilicus, for example, the opening is always a ring, while at the bend of the groin it is always a canal.

Rings.—The first species is only met with on the points of the abdomen where the aponeuroses and the muscles do not form distinct layers, as for instance at the linea alba, or the flank, the vagina, the rectum, &c. These parts being in fact not separable into laminæ, but only opened to allow the passage of the viscera, the hernia arrives under the skin immediately after passing through them, and has only to pass through a mere circle to become formed.

Canals.—The second is more complicated. Its entrance and termination represent two distinct circles, two rings sometimes at quite a considerable distance apart. It can only occur where the several layers of the abdominal parietes are commonly separable. Vascular, nervous, or other chords occupy it in its normal state. Its passage may be said to have parietes, and depends on muscles or other tissues keeping its two orifices more or less apart, and on its two rings belonging to different aponeuroses. If its entrance and exit are exactly opposite to each other the canal is straight or perpendicular, on the contrary it is oblique when they are situated at unequal distances from the median line, which is more frequently the case. Let us add, however, that when of long standing hernias tend to efface the obliquity and the length of their passages and to transform them into simple rings; and this by a mechanism easy to be explained. Pressed in inverse directions by the portion of the organ that has come through and by that which tends to escape, the deep seated and superficial aponeuroses gradually diminish the interspace which naturally separates them, and finally come in contact. Taken in its whole, an oblique hernial canal represents pretty much the shape of a *Z* elongated. But it is evident, that the viscera occupying such a canal, would from their own gravity continually tend to straighten it to bring its openings opposite to each other; and that then, as in the preceding case, they might reduce it to the state of a ring almost perpendicular. But whether it be circle or canal, the hernial opening is almost constantly widened into a funnel at the abdominal extremity, in some persons more than in others. As, on the other hand, the bloodvessels which border on the neck of the hernia, commonly run in the substance of the *fascia propria*, that is, between the peritoneum and the deep-seated aponeuroses, it results that they are generally found removed from two to three lines at least from the fibrous edge which causes the strangulation, or upon which we are obliged to use the bistoury to effect a relaxation.

§ 2. *Seat of Strangulation.*

Although it is commonly at the neck that hernias are strangulated, it also sometimes takes place in their body. In this case the strangulation is produced either by a rupture of the sac which has allowed the organs to escape into the surrounding tissues through an incomplete partition, a contraction, or the orifice of a lateral cell of this envelope, whether from an abnormal disposition of the displaced viscera, or from bands or morbid tumors. The twisting of the intestinal loop upon itself, for example, may produce it; and so may an epiploic band, which may pass in front of the intestine as if to divide it into two portions, before fixing itself at the fundus of the rupture; and also an opening torn in this membrane in the middle of the sac, through which part of the intestine shall have passed. The epiploon may also be rolled into a cord, and fix itself first to one side, then to the other, so as to form a kind of bridge, and even a second one by attaching itself again to the first wall of the hernial cavity. Two of its prolongations sometime approximate after contracting adhesions laterally, and unite a little lower down; leaving between them a space which is also apt to cause strangulation. All kinds of bands may do the same as the epiploon. Hey gives a drawing of one, which fixed by its extremities to the two sides of the sac formed a complete circle in the middle

through which the intestine passed. A hard epiploic mass, of the size of a large hen's egg, had produced strangulation in a patient whose body I had an opportunity to examine. An enormous tumor of the mesentery had produced the same result in a man operated upon by Pelletan. The appendix of the cœcum would also produce it, if it should get into the hernia and adhere at its point. It is the same with the thousand pathological alterations capable of compressing the digestive tube and interrupting the course of its contents. Even inflammation of the sac, caused by external violence, may bring on strangulation, as is proved by the case of a patient published in the Strasburgh collection of theses (1803), who had received a spent ball upon the scrotum. At its root the hernia may be strangulated at first in the manner just described, and afterwards by the opening through which it necessarily escapes. But this opening we now know includes several objects, the constricted portion of the peritoneal elongation, and the circle or fibrous canal which contains it. At first view it appears difficult for the neck of the sac to produce strangulation of itself. Nothing however is more common; the adhesion of its folds to each other very much increases its thickness. Cellular lamellæ are then successively applied to its external face. The plastic lymph deposited there, at the same time unites the whole, and insensibly gives to the part great density, and a thickness which may become considerable; for Arnaud says that it was more than half an inch in one of his patients, and M. Græfe has noticed the same fact. A lardaceous and even semi-cartilaginous appearance is also manifested there in certain cases; in such a way, that being arrested from without by the assistance of the ring, the thickening is affected at the expense of its own calibre by a concentric reaction, the whole force of which bears upon the intestine. Strangulation therefore is sometimes so far independent of the opening in the abdominal parietes, that this remains entirely free, and sufficiently large to allow an easy movement to the neck of the sac, so that we may succeed without difficulty in making it repass into the abdomen without diminishing the constriction at all, if it has not been previously incised. Arnaud, Le Dran, &c., were the first to insist on this disposition, of which Riviere, Schenck, Littre, and Nuck had given but an imperfect glimpse, and the knowledge of which has been made general by Scarpa, after Pott, Wilmer, Hey, and Sandifort. In France, M. Dupuytren is one of those who have most frequently met with it, and pointed it out with the greatest emphasis. Mr. Lawrence, who at first refused to believe in it, admits its existence in the last edition of his works; and at present this mode of strangulation is no longer called in question. It presents even several distinct gradations, may be altogether annular, very circumscribed for example, and occupying but the entrance, the termination, or the middle part of the neck, or invading the whole of this prolongation, and transforming it into a kind of case or sheath more or less compact. The aponeurotic opening, the part to which the strangulation was formerly almost exclusively attributed, also produces it in a considerable number of cases. But since the difference has been acknowledged between the simple *ring* and the hernial *canal*, a distinction as to the neck of the sac has become indispensable; that is, in openings in form of a canal, so far from being always situated at the external orifice as was supposed, it is equally developed at the internal orifice, on an intermediate point, and sometimes on these several parts at once.

The most difficult, and at the same time the most important point in strangulation, is to distinguish it clearly from every other affection. If the tumor is small and had not fixed the attention of the patient, a too superficial examination may lead to the belief of the existence of a violent phlegmasia, of volvalus, poisoning, &c. These mistakes are by no means rare, even when the hernia is not very small. Some days since a surgeon in the neighborhood of Paris, was called to a patient whom he thought affected with gastritis, and treated accordingly. The symptoms continued. A second surgeon was called in who found it strangulated hernia! A domestic of a dignitary of state died last year of what was considered intestinal inflammation; after death it was discovered to be strangulated hernia! A strong and hearty man was seized with violent colics, and convulsive motions; it was thought to be gastritis. Leeches to the epigastrium, &c., were ordered for three days. He was carried to La Pitie. He had a bubonocele which I was able to reduce forthwith. A little more knowledge or precaution in such cases would easily prevent error, though not always, for the most skillful are sometimes mistaken. In 1817 a woman, directress of the infirmary in the hospital of Tours, was seized in the night with colic, vomiting, &c. I questioned her; she had never had a rupture. The next day M. Bretonneau examined her; there was no sign of tumor in the abdomen or the groins. However, pain was increased by pressure in the hollow of the thighs, and from this spot the colic seemed to arise. A strangulation was suspected, but what was to be done? Death took place the following night. A portion of intestine of the size of a walnut was strangulated in the left crural ring, and made no prominence externally.

Peritonitis.—A number of circumstances may be mistaken for stricture of the intestine in persons affected with hernia—peritonitis, for example, when it is accompanied with constipation and vomiting. Upon the advice of two gentlemen in consultation, and against his own opinion, Pott operated upon a young man whose hernia seemed to be strangulated. There was no lesion in the tumor. The patient died, but it was of intense peritonitis. Being called to another case, Pott would not operate. The death of the patient allowed him to establish that the hernia was not strangulated, and that inflammation of the peritoneum had caused all the symptoms. Mr. Earle was no less unfortunate in 1828. The operation proved that an enteritis had led him into error, and that no strangulation existed. Let us observe however that in this case the disease is generally ushered in by a chill more or less violent, that the pains are much more acute in the belly than in the tumor, that the vomitings are glairy, greenish, and not stercoraceous, and that the face tends to shrink, but not to become hippocratic.

Inflamed Sac.—A no less difficult case is the following: the sac of an irreducible hernia, or the intestine which forms it may become inflamed, hence all the signs of acute strangulation. Hernias without adhesions are liable to the same accident. Sometimes however the ring remains free, and in no manner compresses the organs passing through it. To suspect this condition the pain must have commenced at the body or the base, and not at the root of the tumor; the skin itself must have partaken of the inflammation from the beginning, and it must be possible to feel with the finger the laxity of the

hernial openings. This is in fact sometimes the case. But when the hernia is not of any considerable size, how are we to profit from these circumstances? Happily in this case, as in real strangulation, the operation is the best remedy to be employed. The viscera have been reduced—the tumor reappears—symptoms of strangulation manifest themselves. The operation is performed, and the surgeon finds only a pouch full of fluid, either purulent or flocculent, serous or sanious. This pouch is the inflamed sac, the orifice of which has been closed by the inflammation. Numerous cases of it have been reported latterly by MM. Dupuytren, Duparcque, Sanson, and Janson. Mr. Key has also been deceived, and the error could not be avoided if it were not that it is almost always possible to procure some stools, or that the stercoraceous vomitings do not take place as in real hernia.

Certain Hydatoid Tumors may be ranked in the same class, as appears from a case recently published by M. Pigeotte of Troyes, and from those given by Desault, Dupuytren, and M. Roux. A simple imposthumated lymphatic tumor, an indolent abscess, and a common abscess enter with equal propriety into this list. M. Baud of Louvain, thinking to operate for strangulated hernia found only a lymphatic tumor, the pedicle of which he tied. The symptoms were aggravated, the patient sunk; and it appeared from the autopsis, that the thread applied round the elongation of the morbid gland, contained a portion of intestine. The same mistakes may arise from tumors purely fatty, and have been caused by them more than once. Suspecting a strangulation, Scarpa laid bare the supposed hernia, and found only a pedunculous adipose mass, which he excised. After running great risk, the woman in the end recovered. M. Cruveilhier cites a case in which the operator, less fortunate, lost his patient. A woman in the ward of M. Parent at La Pitie, was seized with colics, vomiting, constipation, &c. She had an old tumor at the umbilicus. Being called to her, I observed all the symptoms of strangulated hernia and threatened peritonitis. Before proceeding to the operation, I thought proper to prescribe a bath, leeches, cataplasms over the abdomen, and enemata of various kinds. They forgot to transfer her to my ward, and death took place on the third day. There existed an intense peritonitis having its point of departure on an old lesion of the sexual organs, and the supposed hernia was nothing more than a pedunculous fatty tumor. An epiploic lump may be transformed into a hydatid, or a hard and immovable tumor, become inflamed, form abscess, and be no less embarrassing, especially if an intestinal loop exist simultaneously in the hernia. A reaper was suddenly seized with colic and nausea, and at the same time perceived that a tumor as large as his fist had descended into the scrotum. He was admitted at La Pitie on the seventh day. The hernia was formed of two portions; the superior, soft and not very sensible, which I succeeded in reducing; the other very hard and larger, which it was impossible to return. The symptoms, without being very alarming at first, continued for three weeks, and became so aggravated that the patient was on the brink of the grave, when a purulent discharge from his tumor put an end to his sufferings and restored him to health. In the clinical observations of Pelletan is a case very nearly similar. The epiploon may also occasion error in another way. A patient affected with abdominal hernia died with symptoms of strangulation. The

necropsis showed that the epiploon, although scarcely diseased without, was violently inflamed in the interior of the abdomen, where it formed a kind of hollow cone, of which the base embraced a preparation of the stomach.

Internal Strangulations.—Another species of disease much more capable of leading into error, are the various kinds of internal strangulation, or obstacles to the passage of substances through the alimentary canal, in persons who are at the same time affected with hernia. A woman forty-two years old, who for eight years had been affected with omphalocele, came to the hospital of the Faculty in the month of March 1824 with symptoms of strangulation, and would have been subjected to the operation if it had not been discovered that she had in the right iliac fossa a deep-seated tumor, hard and very painful. This tumor opened externally and was emptied; a stercoraceous mass contained in the cœcum constituted it, and had evidently caused the constipation, vomitings, &c. Another woman, forty-nine years old, received in the same hospital in July 1825, vomited continually for twenty-four hours without its being possible to obtain a stool. The abdomen was tympanitic and exceedingly painful, the pulse small, hard, infrequent, &c. There existed at the same time a crural hernia. On opening the body I found the commencement of the rectum transformed into a lardaceous tissue and completely closed. The merocele had not suffered at all. Every tumor, polypus, fibrous or cancerous, originating in the intestine, will necessarily produce the same consequences if it acquire a considerable size. A man about sixty years old, a great eater, who had remained a long time in the hospital of Tours for vomitings and a constipation which nothing could overcome, at length died. The small intestine, largely dilated above, was closed about its middle by a cylindrical mass more than a foot long, and about two and a half inches in diameter, partly free and partly adherent, the result of an old degenerated invagination. If the hernia with which this man had been formerly affected had still existed, the symptoms observed during life might have been attributed to it, and as the result shows altogether improperly. Similar cases are found in numbers in the scientific compilation. A patient who was sent to me from the ward of M. Andral in October 1831, furnished me with one of the most remarkable. The memoir of Hevin, which contains them all, proves at the same time that the different gradations of invagination have often resulted in the same train of symptoms. It may also happen that these symptoms depend on a spiral twisting of a loop of the small intestine upon the mesentery, or on its flattening against the spine, of which the death of Chopart affords a proof; or a circular stricture of one part of the organ reduced after having been long engaged in a hernial opening, as in the case reported by Ritsch; or the neck of the sac being pushed into the abdomen with the hernia, as is seen in the observations of Le Dran, Arnaud, &c.; more frequently still on the digestive tube being engaged, to the point of strangulation, in some slits, or under some bands or appendices of the abdominal organs. Thus M. Berard has seen it enter the anterior mediastinum by separating the xiphoid fibres of the diaphragm; it has often passed into either pectoral cavity through the body of the diaphragm itself; through a slit in the epiploon as we find in Arnaud; of the mesentery as Saucerotte affirms; through the foramen of Winslow, and an opening in the transverse mesecolon as observed by M. Blandin; between the bladder and the pubis, where an epiploic band fixed in an inguinal sac kept it

strangulated under the cæcal appendix attached by its point to some point or other of the abdominal cavity; under an accidental curvature of the intestine; an epiploic arch attached on the one part to the spine, and on the other upon the superior strait of the pelvis, as seen by M. Bonnet in the body of a patient who died at the hospital St. Antoine; under an enormous band in the form of a T, the horizontal branch of which extended from the liver to the left flank, and the vertical portion to the right iliac fossa; in fine, under the thousand varieties of bands and chords which disease or accident may produce in the interior of the abdomen. The strangulation produced by these numerous causes, after all only differing from herniary strangulation in having its seat in the interior of the splanchnic cavity, may easily induce error in subjects who have also a visible external rupture. They are to be distinguished however in the majority of cases, by remarking the point of departure of the pains and their course; by comparing the condition of the tumor with the condition of the abdomen and *vice versa*. When it exists alone there is hardly ever a mistake, but we are then to specify its kind, and see if art can afford a remedy. This is a question that cannot be discussed at present, but will find a place in a subsequent article.

§ 3. *Indications.*

It must be seen by what has been said that strangulated hernia is an extremely serious disorder, and one which without the assistance of art will almost constantly prove fatal. When once recognized, therefore, it is important to remove it to apply a remedy. To obtain its reduction or relieve the strangulation is the end to be attained. To say with Richter and Callisen, that it is first necessary to combat the inflammatory tendency, the pain, &c., in order to diminish the constriction of the parts, would be to take the effect for the cause, and attack the consequences instead of destroying their origin. To arrive at this, the operation is not the only means which the surgeon may employ. It is but a last resource. Before attempting it, the *taxis*, blood-letting, baths, clysters, opiates, and various topical applications may or should be tried.

1. *Taxis.*—The first idea that presents itself when a patient is seized with strangulated hernia, is to attempt to return it into the abdomen, and in truth this is the usual commencement. To perform the taxis, the patient is laid so that the muscles may be easily relaxed, commencing, as Sourdiere has well shown, with the sterno-mastoid muscles; not as is generally supposed that this position favors the reduction by permitting the aponeurotic openings to yield and enlarge, but because the contrary position favors much more the expulsion than the return of the viscera, lessens rather then enlarges the abdominal cavity. He is then to make no effort, no movement, but to remain perfectly relaxed. The surgeon placed on the right, grasps the tumor with one hand, draws it a little towards him so as to disengage it from the ring, seizes it at the neck with the first two or three fingers of the other hand, then pushes it up in small portions, commencing with those which have last escaped, and directing them in the axis of the herniary opening. As soon as one portion is reduced, the fingers of the second hand retain it and prevent its return, while the right endeavors to reduce another portion, and so on until a mass remains small enough to be returned at once under the influence

of proper pressure. When the reduction takes place freely, this last portion, pushed by the extremities of the five fingers of the first hand, passes through without stopping, and gives out a characteristic sound called *gargouillement*, a sound which is caused by the fluid heretofore imprisoned in the displaced intestinal loop, quickly leaving it to restore an equilibrium in the whole canal. Epiplocele, which is besides distinguished by its uneven, rugged form, by its soft, clammy consistence, produces no *gargouillement*, and does not yield with as much facility as enterocele. The taxis should be performed according to the same rules in both cases, that pressure may be carried much farther in the second than in the first without inconvenience. When after some time a portion of the hernia disappears suddenly and with noise, while the remainder rests stationary in the sac, it may be concluded that there has been entero-epiplocele, and that it is the intestine that is reduced. It is proper however not to forget that enterocele strangulated by obstruction, may easily be mistaken for epiplocele, and that its reduction is not always accompanied with a sound of *gargouillement*. If the tumor is small, the fingers of the left hand may be employed to support its circumference, while those of the right press upon it in every direction. Even when it is of a considerable size we may endeavor to restore it *en masse* if the strangulation is not very decided, and if the hernia has passed through a simple ring. We may also, when it is very large, grasp it with both hands and compress its whole surface at once, as for emptying a bladder full of fluid. The gas and semi-fluid matter thus compressed, sometimes re-enter the abdomen so as to remove the strangulation, or singularly facilitate the after reduction of the viscera. This process has succeeded with me a number of times. Moreover, after vainly trying one mode we should attempt another, and the taxis is, after all, an operation which practice and the anatomical knowledge and intellectual resources of every one teach better how to perform, than all the details found in the best authors. To repeat; put the parietes of the abdomen in a state of relaxation; support the neck of the tumor with one hand while pushing it back with the other, so as not to let it bend over the edges of the ring instead of going through it; disengage it a little, lengthen it, *knead* it in a manner so as to spread its contents over as great a surface as possible; grasp it largely with the hands or the ends of the fingers, as its size may admit; have it grasped even by the hands of an assistant if very large, while the surgeon himself holds the root; urge it back by the same passage through which it has issued; suspend the efforts and resume them shortly after; vary their direction and energy; use them to the best advantage, but be cautious of carrying them so far as to create danger; these are the only rules the operator requires in performing the taxis. I will add that in large hernias, particularly the epiploic or *obstructed* it is often useful to continue the taxis by means of a *methodical* compression, until it can be resumed with the hand, when it has not completely succeeded at first. In 1825, a man forty-seven years old, affected with an enormous entero-epiplocele, was admitted into the hospital of Improvement. Attempts at reduotion frequently repeated on the evening of his entrance, and the next day were attended with no success; but as there was no sign of inflammation, and the symptoms made slow progress, it was decided to wait. The second day the action of the hand was again attempted, and the intestine was in part reduced. To prevent its return, I forced the

whole tumor in a suspensory bandage furnished with compresses. I thus succeeded in exerting an exact and considerable pressure upon it, which reduced it one half in the course of the night, so that the taxis then succeeded without difficulty.

The smoothing iron, the piece of lead, and the bladder filled with mercury, applied as weights upon the hernia, in which Wilmer and some other English surgeons say they find so much to recommend, are in reality but compressing means, of which an appropriate bandage will always advantageously supply the place. If the taxis has the advantage of often rendering a serious and painful operation unnecessary, it is itself far from being entirely unattended with danger. The viscera in which the circulation is badly conducted, irritated by the constriction, and already more or less inflamed, must become still more violently inflamed under this pressure. It is well known that unless we proceed with all possible care, it will be very easy to contuse them, to bring on mortification, or tear them and expose the patient to the greatest danger. Thus for a long time it has been remarked that the operation was so much the less likely to succeed as the attempts at reduction had been more numerous. There are some persons, says Petit, who will succeed at any cost, and boast of reducing every hernia; they compress, bruise, and inflame the intestine, and it is always with repugnance that I perform the operation on patients who have undergone such trials. Pott directs that we should not wait longer than two hours. After he had formed a custom of acting with this promptness, nearly all his patients got well. Previously he had lost half. Comparative trials made at Hotel Dieu, had proved to him that the proportion of success after celotomy was considerably greater in patients operated upon without having been fatigued by the taxis than in others. At the hospital of Orleans, where the operation was performed from the first, Leblanc was rarely unsuccessful; while at Paris, where it was left until very late, most of the subjects died. It was for this reason that Richter attempted to proscribe the taxis. He declares that he has rarely seen a hernia really *strangulated* reduced by this means, and contends that those which have yielded to it would have gone back of themselves a few hours later. These apprehensions, a little exaggerated, are only well founded in the cases of enterocele and inflammatory strangulation. The attempts must have been very awkwardly prolonged to cause the suppuration of the epiploon noticed by Arnaud, and immediate gangrene of the enterocele from obstruction, &c.; but it is readily conceived that in acute strangulation the taxis if unsuccessful may become dangerous, and render the operation infinitely more formidable than if it had been but feebly exercised. However, in abandoning it too early we are liable to perform a grave operation without necessity. Sometimes by renewing our attempts, twice, thrice, or even six times, we succeed in reducing a painful hernia which had resisted all previous endeavors. In other cases attempts no less numerous, although unsuccessful, have not prevented herniotomy, performed after the lapse of two or three days, from succeeding completely. In fine, a strangulated hernia has been seen so frequently reduced by one surgeon after having been vainly attempted by another, that it is difficult not to hesitate when it is proposed to abandon the taxis. A porter next door to me had an old hernia which was strangulated in the morning, only in consequence of a single effort, and notwithstanding his bandage. During the day there were

three failures in the attempt to reduce it. I saw him at eight o'clock at night. His suffering and agitation were extreme. He could not be touched without uttering piercing cries. The whole pain was in the tumor, which seemed unable to bear the least pressure. I would not hazard an operation however before trying the taxis again. I obtained nothing at first but a quick and involuntary motion in the patient, while a second effort returned the whole of the intestine. The symptoms disappeared immediately, and the next day this man was able to resume his ordinary occupations. In the month of March 1825, M. Demay requested me to see with him at the barriere de Sevres, a woman who had been laboring under a strangulated merocele for thirty-six hours. The tumor was of the size of a small egg, very hard, painful, and evidently formed by the intestines. After subjecting it to the taxis, I thought that it had considerably diminished and would not operate. I returned there the next day, and attempted the reduction with no more success than before. However, as I found it in the end less in size, I persisted, and the operation was deferred a second time. Twenty-four hours after, at our third visit, we were all disposed to wait no longer, but to relieve the strangulation immediately; and when I least expected it, this hernia disappeared under my fingers, and two days afterwards the patient was in good health. Although these cases tend to prove that in general we must not take too literally the advice of Pott, or Richter, and set aside the taxis from the first, yet I do not mean that they should give too much boldness to the young practitioner. It is but too common to see in our days what Petit might exclaim against, as in his own time. "How often is it seen that patients die the same day the reduction has been made. In some the gut is found gangrenous; in others it is burst, and fecal matter poured into the abdomen." If we are to believe a medical journal, this accident happened in the month of April last in one of our great hospitals, the very day on which the surgeon had dilated upon the dangers of forcible taxis. I know besides that this misfortune happened a short time afterwards in the same establishment. In both cases the intestine was torn, and *The Lancet* relates similar accidents occurring in the London hospitals, one in particular under the care of Mr. Calloway. The case mentioned by Lassus is not at all surprising, since the young man had conceived the singular idea of using a stick by applying one end on the tumor and the other against a wall. Therefore the point is not to reduce it at any risk, but only to know how to make use of the taxis properly. Small, recent, and painful hernias bear it ill; because the opening which gave them passage is narrow, and very tight; because, moreover, the intestine thus bridled, inflames, becomes altered, and often gangrenes with the greatest rapidity. The same may be said of hernias which reappear suddenly, and become strangulated after having been long retained by a truss. It is so much the more dangerous as the subject is younger, more robust, and more irritable. In chronic strangulation it would be imprudent to operate before recurring to it several times, and that even with considerable force. The most of old hernias are of this class. The presence of the epiploon, of a layer of fat, or of a portion of the large intestine in the sac, diminish its dangers, because these several objects resist pressure better than the small intestine. For the rest it is not the time elapsed since the appearance of the first symptoms, but rather the state of the parts which should regulate its application. In some subjects, gangrene or ulcera-

tion supervenes almost immediately upon strangulation. M. Larrey found it to occur in two hours, Richter after the lapse of eight, and Mr. Lawrence at the end of twelve; while in other cases apparently similar, it had not been manifested on the fifth or sixth day. In 1824, at the hospital of Improvement, I operated upon —— Moliere, who had been four days affected with strangulated hernia. The intestine, although livid, was not mortified, and the cure readily took place. Some months afterwards another patient was carried to the same establishment, to be there operated upon for a similar accident. The symptoms which had existed but twenty-two hours, were exhibited with less intensity than in the first. The hernia as in that case was crural. However, the intestine was perforated, and notwithstanding its liberation the patient died during the night. On inspection of the body, alimentary substances were found effused in the abdomen, and gangrene had invaded a great part of the digestive tube.

As long as the skin is neither red nor very sensible, nor positively inflamed, while direct pressure upon the tumor does not too much increase the suffering, and while there is no very evident sign of a true inflammation of the abdominal peritoneum, nothing obliges us to abstain from it unless it has already been tried by experienced persons. In the contrary case it would be best to renounce it, unless no attempt whatever has been previously made. Every thing is then to be apprehended, supposing even that we succeed, in returning into the abdomen a half mortified intestine, if not a perforated one, and the dark putrid matters, more or less acrid, which usually surround the sac. When it is much inflamed, the operation is *cæteris paribus* the most certain means to propose to the patient. It is scarcely more dangerous at this moment than the taxis, and has the advantage over it of removing immediately every obstacle, and of not aggravating the condition of the viscera contained in the tumor. If deferred, it will not be the same. The organs, contused, lacerated, or gangrenous, do not offer the same hopes of success, and the operation perhaps may only hasten the transmission of the disease to the interior, and consequently its fatal termination.

Instead of placing the patient as described above, some surgeons, Winslow among others, were in the habit, in the last century, of putting them on their knees, the head low and resting on the elbows, while the taxis was performed. some credulous or bigoted souls took occasion from this to induce the individuals thus prostrate to make fervent prayers, pretending that if in this posture their hernia was reduced, that it was to the divine interposition they should ascribe it. A practice much more ancient, used also by Louis, Hey, M. Ribes, &c., and which M. Jobert says was successfully followed by M. Girauld, consisted in seizing the legs of the patient and hanging him up by the hams upon the shoulders of an assistant who gently jarred him, while his head and back rested upon the bed, or while another person performed the taxis. It is possible that this resource may not be of much value, but it does not seem to me to deserve the neglect into which it is fallen, nor the ridicule which has been cast upon it at the present day. Mr. Lawrence is evidently mistaken, when he says that the abdominal viscera are too exactly supported throughout for the simple position of the patient to carry them more in one direction than another. We may every moment have proof of the contrary by observing on ourselves that the intestines float always to the most depend-

ing point of the abdomen; in the vertical position towards the hypogastrium, and towards one or the other side when we lie on the right or left. I conceive then that by holding the patients by the hams there is some chance of the displaced organs leaving the hernia to be carried towards the diaphragm, which in this case becomes the inferior wall of the abdomen. There would be danger in doing so, for the same reason, if the intestine or peritoneum be already inflamed or if from any other motive whatever, we have to dread all kind of dragging on the part of the abdomen or the hernia. For the purpose of methodising and generalising this succussion, Linacier of Chinon invented in 1819 a kind of pivot bed or tumbril covered with cushions, upon which he fixed the patient so as to shake him more or less briskly by alternately letting fall and raising the head of this apparatus. However ingenious it may seem, this bed was not adopted and should not have been so. In the first place it is not to be found every where, and is not indispensable, and then the patients are stretched upon it at full length, while by suspending them by the hams they may be kept flexed, and greatly bent upon their anterior plane. If succussion is to be tried, this last mode of operating ought to be preferred as the most simple, least dangerous, and quite as efficacious as any conceivable machine. I need not here remark that the taxis ought to be renewed with all possible care, while the assistant or assistants keep the patient suspended; that, as in the case of the young man mentioned in the Lancet, it would be well also to draw the abdominal wall upon the side opposite the hernia, and that the concussions upon the pelvis are not indispensable.

2. *Baths.*—If the hernia is obstinate, the taxis should not be employed alone. The bath is an accessory which is then scarcely ever to be neglected. It calms or diminishes the pain, the spasm, the rigidity of the tissues, the tenesmus, and inflammation itself if existing. It is used of the temperature of 28° or 30° Reaumeur (100° Fahrenheit) or a little lower. The patient remains in it from one to two hours. Desault directs a cloth suspended at its four corners so as to make a kind of bed of the body of the bathing tub, where the patient may lie moderately flexed and be subjected to further attempts at reduction. Some practitioners repeat it once and even several times during the day, that is, when the tumor is more urgent or the operation not decided on. However if more powerful means have been employed it would be useless to have recourse to it, and lose precious time in ineffective efforts. Although the warm bath is proper in almost every species of strangulation, it is in acute, inflammatory, intestinal strangulation, in young and robusts subjects, that it ought particularly to be used. As it has not, like the taxis, the disadvantage in case of failure of increasing the danger; as, if the operation may have become indispensable, it can only be favorable to success, there is no reason to neglect its use except in cases which will not allow us to temporize.

3. *Bloodletting.*—The unanimity of surgeons in regard to the utility of warm bathing in cases of herniary strangulation is not so complete upon that of bloodletting. Although extremely extolled by Dionis, by almost all the academy of surgery, by Pott more than any one else, and recommended by the most distinguished authors of our day, it has been as it were proscribed by Wilmer, Alanson, and Sir Astley Cooper. Dr. Hey also acknowledged that it is most frequently useless, and that it was necessary to restrain its use. The surgeon of Coventry condemns it as enfeebling the patient without favoring the reduc-

tion in the least. It has, says he, influence neither upon the aponeurotic opening, nor on the strangulated viscera; it can no more enlarge the one than diminish the size of the others; in fine, it remains to be proved whether bloodletting has ever removed a well attested strangulation. To these objections, the principal fault of which is their being too absolute, we have first to oppose the experience of every age, which has often demonstrated that a hernia resisting the taxis until then, has been very easily reduced after copious bleeding. By producing a general shock, this means is calculated to facilitate the return of the displaced organs, to diminish the resistance of the muscles, the engorgement of the tissues, local congestion, by consequence the volume of the strangulated parts, and thereby all inflammatory fluxion. Carried to syncope, bloodletting puts in motion the peristaltic action of the intestines, so that after, they return completely of themselves under its influence. Thus it will be well when we wish to attain this end, to open the vein largely and keep the patient erect during the bloodletting. To understand the importance of bloodletting it is necessary to specify the cases that require it. Obstruction, epiplocele, and every species of strangulation in the aged would be rather aggravated than diminished by it. Delicate subjects and old hernias do not bear it without inconvenience unless it is formally indicated by well marked inflammatory symptoms. On the contrary, in young and robust persons with recent, acute, intestinal strangulation, it is of incontestible utility, and should rarely be neglected were it but to extinguish or lessen the phlegmasiac movement tending to invade the abdomen. It would be improper however in any case to fix upon it, like Pott, an exaggerated value. It would not be very rational to depend on its efficacy after repeating it two or three times, even in patients in whom it is best indicated. It is an accessory means, which like the bath will rarely of itself suffice, and in truth only deserves so much confidence, because it serves at the same time as a precaution against future accidents

4. *Purgatives.*—In the last century, Legrand, a surgeon of Arles, proposed the use of Epsom salts as a kind of panacea in strangulated hernia. According to him this medicine incites and titillates the intestine, and frequently causes it to re-enter the abdomen and discharge the matters which may have accumulated therein. Most violent purgatives, emetics in nauseating doses, ipecacuhanha for example, have been also recommended. Richter and Heberden, who have employed them, profess to have obtained real advantages from this exhibition. In France they have never enjoyed much reputation, and the medical ideas attempted to be spread for the last twenty years, have not been of a kind to bring them into favor among us. Although their irritating action is infinitely less dangerous than some have imagined, yet in my opinion it would be hazardous to trust to them in acute or inflammatory strangulation. I would employ them freely, on the contrary, when there is only epiplocele, or fatty hernia, and the course of substances is not mechanically interrupted in the digestive tube; and even in enterocele which is only strangulated from obstruction and does not threaten inflammation. As they solicit the secretion or exhalation of a great quantity of fluid and a vernacular motion more evident in the superior portion of the canal, as they may produce the re-establishment of the stools or the softening of the obstructing substances, it is easily conceived how they may have had success, and still preserve partisans, as M.

Gaussail gives proof quite recently in the weekly journals. But it is a species of remedy too difficult to manage, too treacherous, and too rarely useful for me to venture formally to recommend it. The following however is a case which I cannot pass by in silence. A woman thirty-two years old was in the fourth day of a strangulated hernia. Every thing had been tried, baths, bleeding, taxis, and clysters of all sorts. The belly was tympanitic and painful. The vomitings, constipation, pulse, and countenance left no doubt as to the dangers under which this woman must sink if the operation was not performed without delay. The patient positively refused to submit to it. Having nothing further to hope I gave her every thing she desired. At her earnest entreaty some milk and a purgative were administered to her. During the day she took two ounces of castor oil. The symptoms continued until 5 o'clock P. M. but shortly afterwards were calmed, and at my visit the next morning, the students who had watched her and myself could not have been more astonished at finding her out of all danger. Her recovery was complete.

5. *Opiates.—Antispasmodics, opium*, and other substances capable of modifying the general economy, whether singly, or combined with purgatives as Richter, Heberden, &c. were in the habit of employing them, scarcely deserve to be called to the notice of the reader. The sole advantage they can promise is to calm for a time, to palliate the colics, nausea, distress, in fine some of the symptoms produced by the strangulation; but to terminate the strangulation itself is not in their nature. I do not see why belladonna which was for a long time extolled, and given in a large dose as directed by M. Chevallier, can be of more avail than opium. The oil of turpentine, given by Drs. Sewall and McWilliams in the quantity of two ounces at a time, so that the patient swallowed eight ounces in twenty-four hours, will probably never be tried in France, and therefore deserves merely a passing mention, notwithstanding the success attributed to it in America.

6. *Enemata.*—At the same time that one or all of the preceding means are employed, it is customary to solicit the large intestine. The principal intention being to provoke the passage of matter situated below the strangulation, or at most to produce an anti-peristaltic motion in the whole of the digestive tube, some persons use simple, laxative, or common purgative injections. Riviere thought that by injecting air into the anus by a bellows the displaced organs might be returned into the abdomen. MM. Hufeland and Van Loth, pretend to have cured several patients by injecting hyosciamus or belladonna into the passage, as is also recommended by M. Pauquy in his thesis. But in this view tobacco is the substance most employed. It is given in smoke by means of an apparatus that every one can invent and construct; or, which is at once more convenient and certain, in infusion the same as any other clyster. In this last case a dram of tobacco to a pint of water is the proper dose, which it might be dangerous to exceed. Sir A. Cooper has seen it cause a kind of poisoning, which actually occurred in another case in which two drams were used; and the same accident has happened since in the ward of M. Marjolin. Without believing with Heister, that it is an infallible remedy, or with Pott, that nothing further is to be hoped for after using it in vain; without giving it the same confidence as Hey, Lawrence, Rose, and the greater part of English surgeons, it cannot be denied that the tobacco clyster has more than once removed the strangulation and rendered the operation unnecessary.

For myself I have seen but one case, but it was a remarkable one; every thing was ready for the operation, yet before it took place M. Richerand had occasion to send for something out of the hospital. During this time a tobacco injection was administered, and when about to expose the hernia we all saw to our great surprise that it had been reduced. The symptoms ceased at the same time, and the young man left the next day to resume his ordinary occupation. It is true I have seen it employed again in the same hospital, and I have used it since in twenty-five cases at least without any benefit. The *oppressio virium*, the deep colics, the cold sweats, the tendency to convulsions which it usually produces, are evidences of the energy of its action. As it determines at the same time violent vermicular contractions in the whole length of the intestinal tube, nothing is easier than to understand the effects attributed to it in strangulated hernias. For the same reasons that render it powerful and of incontestible utility, tobacco may be sometimes dangerous. When the constriction is very decided, the hernia recent, purely intestinal, and complicated with inflammation, and the strangulation acute, prudence opposes its employment. On the contrary, it is very proper in every kind of obstruction, and strangulation of the large intestine and of the epiploon; whenever in fine the inflammatory symptoms are but little developed, and there is no reason to fear the effect of tractions upon the displaced organs. After trying it in the dose of a dram, under these circumstances, we may and ought, if it produce nothing manifest, repeat it once or oftener, and throw up two drams at least provided no narcotism nor other general accidents are to be apprehended.

7. *Topical Applications.—Leeches.* Cataplasms which have been advised and used by a number of practitioners, can be of no real use except in very few cases. If the tumor is neither hot, nor tense, nor painful, nor really inflamed, their usefulness is more than doubtful unless they act from their weight; and if the contrary condition exist, we cannot wait long enough for their emollient properties to produce any effect. For the rest, as they do not interfere with the use of the bath, bleeding, and tobacco clysters, I see but little inconvenience in covering the hernia with them in acute strangulation as long as the operation is not urgently demanded. It is otherwise with respect to leeches, which many apply upon or about the tumor. Experience says nothing in their favor, and reasoning proves that they may be injurious in every hernia without inflammation, and in inflammatory strangulation itself; for there they can at best but act against an effect, while it is the cause that should be removed. The ecchymoses which result from them have besides the disadvantage of increasing the thickness of the herniary envelopes, of deforming and deranging them, and thus rendering the operation more difficult. If they are ever useful, it is at most in strangulation of an inflamed epiplocele of some adipose tumor or other independent of the intestine. Refrigerants perhaps deserve a little more attention. Compresses wet with cold water, ice water, chloruretted solution, vinegar and water, frictions with acetic ether, all the means in fine which when applied upon the tumor remove a large proportion of caloric, may favor the reduction in three ways; 1st, as discutients by diminishing the afflux of the fluids; 2d, by condensing the gaseous fluids in the strangulated loop of intestine; 3d, by soliciting the peristaltic action of the digestive tube. It is seen from this simple enumera-

tion in what cases they would be proper, and what it is reasonable to expect from them. A much more powerful mode of employing them is one followed by some old women in the country, and described by J. L. Petit. Being called to a young man to operate, this author, accompanied by some of his professional brethren, was ready to commence, when the grandmother of the patient entering the chamber attempted to drive them all out, and said she was going to cure her child off hand. After extending him naked upon the floor, she ran to the well and drew a bucket of water, which she threw suddenly upon the hernia. The fact is, says J. L. Petit, who requested permission to be a witness of the experiment, that the intestines returned almost immediately, and the young man was cured without an operation. Every one understands the action of these means, and that they might be employed with some confidence, if when unsuccessful they were not of a nature to favor the development of the numerous phlegmasiæ which sometimes follow herniotomy. In order that gangrene from congelations, noticed by Sir A. Cooper, be feared, ice, snow, and every other, even the most powerful refrigerant, must be used with very little precaution, and I doubt if such an accident is really to be apprehended. Much has been said of the belladonna of late in the reduction of hernias. M. Speziani made a pomatum of it with which he smeared the tumor; MM. Meale, Pages, Faye, and Magliari, did the same with success; M. Saint-Amand was not less fortunate, using it in cataplasms; M. Riberi covered a bougie with it, which he introduced into the urethra, and declares that he has in this way been successful. M. Guerin of Bordeaux, long since used opiated bougies, daily introduced into the canal of the urethra as a remedy for herniary strangulation. To say that great confidence may be reposed in such means I cannot; but as they are of easy application as well as void of danger, I see no reason why they may not be used when there is no need of an immediate operation. I have employed them six times. The tumor, greased morning and evening with the ointment of belladonna, was covered with simple cataplasms. Twice I introduced the same substance into the anus on a strong bougie, and I must confess that several of the patients seemed to be relieved. As for explaining their mode of action, we must wait I think until a greater number of facts are given in their favor.

8. *Acupuncture.—Galvanism.* I do not speak here of astringent cataplasms, as the promegranate and decoction of walnut leaves which Belloste so much recommends, supposing them to have been long since generally abandoned; but I cannot dispense with saying something on acupuncture and electro-puncture. Since the time of Pare, surgeons have sometimes ventured to pass a long needle or small trocar once or oftener through the hernia, for the purpose of giving vent to the gas contained in the strangulated intestine. Pott says such a practice is absurd, and does not require refutation. Most of the moderns are of the same opinion. It has nevertheless been employed in my presence on a patient upon whom I operated immediately afterwards; and I am assured by a young candidate in medicine, that his father has often tried it with success. I think it ought to be rejected; first, because it cannot rationally be applied but to enterocele distended with æriform fluids, and secondly, because one of these two things occurs; either the small wound closes when the needle is withdrawn, and it is as if nothing had been done, or it remains open, and in this case it is to be feared that the intestine when

returned into the abdomen may allow the escape of some particles of the fluid usually contained in it. This last accident however cannot easily take place, for every traumatic perforation of the digestive tube, which is not more than a line or two in breadth, seldom fails of being immediately obliterated, either by the approximation of its edges, or by a swelling of its mucous membrane. For the rest acupuncture is a bad means, and if it is to be tried at all a very fine canula should at least be used, which may give passage to the gas after being introduced into the tumor by the needle. Electro-puncture with which M. Leroy (of Etiolles) has made experiments upon dogs, has not to my knowledge been yet applied to man. It consists in placing by means of a steel point, one extremity of an electric or galvanic circle in the tumor, while the other extremity of the same circle is placed upon the tongue or anus, according as the hernia is formed of the small or large intestine. Theory teaches that the currents or discharge from a pretty strong pile or trough thus directed, are calculated to create in the displaced viscera sufficient movements to sometimes determine their return into the abdomen. It is for experience to confirm these conjectures. After all the resource is easily tried in a better way than by electro-puncture, as it may be applied by means of simple electric circle without needles.

Recapitulation.—Let us imagine the practitioner supplied with these various means, actually in presence of an individual affected with strangulated hernia. Suppose it an old enterocele become all at once irreducible. If attempts have already been made, before renewing them he will have the patient placed in a bath, and commence by a copious bleeding from the arm if he is robust and threatened with inflammation. If the taxis does not then succeed, the large intestine is to be emptied by means of laxative enemata. Tobacco infusion will have its turn two or three hours after. If the state of the forces permit, the bleeding is to be repeated together with the bath and the taxis; then come the frictions with belladonna, and the bougies, according to the method of M. Riberi, or M. Guerin. If all is insufficient, and there is no urgency, embrocations, cold applications, compression, and lastly, electricity, may be tried. In cases of acute strangulation, of recent hernia, the taxis, bleeding, baths, clysters, cold or narcotic applications should rapidly succeed one another. If there is already inflammation in the tumor, the tobacco injections, electricity and compression are no longer applicable. The taxis also should be performed with the greatest precaution. If the pain and other inflammatory symptoms leave no doubt as to the state of the parts, bloodletting and bathing can only be considered as preparatives; all topical applications should be neglected, and the operation performed as soon as possible. Leeches in great number, and emollient cataplasms will only be proper when the symptoms seem to depend on an epiplocele or tumor foreign to the intestine. When the hernia is formed by the large intestine, or the progress of the symptoms is tardy, we commence with the taxis or the bath, then have recourse to tobacco clysters, opiates or belladonna, refrigerants, and electricity itself; but venesection should or may be most frequently omitted. The same course is followed when there is only obstruction; and in this case, in the intervals between the use of the taxis, compression by means of a proper bandage may be of service, as in case of epiplocele, freed from adhesions and inflammation. In fine, having tried every thing, and modified our attempts according to the

nature of the symptoms, if the hernia be retained by adhesions, or if the ring oppose an invincible resistance, we must not think of reducing it. If there be yet time, celotomy, in which the chance of success is the greater and the danger the less the earlier it is employed, should no longer be deferred. As the treatment required by the patient is the same after reduction as after the operation we will not refer to it at present.

§ 4. *Herniotomy or Celotomy.*

A. *Enterocele.*—The operation for strangulated hernia was not positively known before Rousset. Maupasius seems to have been the first to point out its advantages. Until then celotomy was performed only for the purpose of producing a radical cure of ruptures. It consists of several stages: incision of the integuments, division of the tissues situated between the cutaneous envelope and the peritoneum, opening of the sac, examination and appreciation of the strangulated parts, destruction of the strangulation, and reduction of the displaced viscera; such are the phases through which the surgeon proposes to run, after arranging his apparatus, the patient, and the assistants.

Apparatus.—A fold of lint spread with cerate and sufficiently large, rolls and dossils of charpie, adhesive strips, oblong or square compresses, a long roller or rather a special bandage, a straight bistoury, a convex bistoury, Pott's concave bistoury, a straight probe-pointed bistoury, good dissecting forceps, straight scissors, a director without cul-de-sac, several ligatures and needles, in addition to the accessories of every great operation, are the various objects necessary, which are to be placed in order on a large dish, or on a shelf.

Position of the Patients and Assistants.—The table covered with a mattress, or the bed on which the patient is laid, requires nothing particular except to be properly protected by cloths, and of a convenient height and width. No one at present imitates Louis in sitting on a stool between the legs of the patient held on the edge of his bed. They stand, kneel, or sit on the right. The patient, in a horizontal position, and nearer the right side than the left, is in a state of complete relaxation. An assistant watches the motion of his head and arms, another attends to his inferior extremities; a third stands opposite to the operator to stretch the skin, sponge the wound, &c.; the fourth is free, and is charged with handing the instruments.

First Stage.—The parts should be previously shaved, washed, and dried. If the skin be too tense, too thick, or too adherent, the surgeon with a convex bistoury divides it as in simple incision from without inwards, taking care not to go too deeply at first. In the opposite case he takes up as large a fold as possible, one extremity of which he gives to an assistant, and immediately divides it either by puncture from within outwards, or which is better, from its edge towards its base. This fold has the advantage of less exposing the viscera to be cut, but the incision is less regular, and can never be prolonged sufficiently at a single stroke, if the hernia is voluminous; so that *cæteris paribus* simple incision is preferable when we are sure of one hand. The wound should be in the direction of the greatest diameter, and of an extent proportioned to the volume of the tumor. We do not give it the T or crucial form except in particular cases. When it is not long enough at first, instead of passing a director successively under each of its angles, to enlarge the

wound with scissors or the straight bistoury, the operator takes up one of the lips and directs the assistant to take the other, so that the index finger rests in the wound and the thumb on the skin at the inferior end; the thumb in the wound and the finger on the integuments at the superior end; he separates them a little, reflecting them outwards, and then with the convex bistoury enlarges the wound as much as he thinks necessary. By the other method much more pain is produced, the skin slips over the director, puckers, and is incised with difficulty. The vessels opened during this first incision are rarely large enough to require the ligature. It is usually sufficient to rub them a little, or to have the assistant's finger applied over their orifice for a time to stop their bleeding; otherwise twisting them is a very simple thing.

Second Stage.—The division of the laminæ which come after the skin requires the greatest attention, and should be made very slowly. In fact, they are not sufficiently distinct from each other, nor sufficiently uniform in respect to thickness to insure us against wounding parts which it is important to save, or to permit us to proceed with extreme reserve, feeling our way carefully until we arrive at the sac. The most certain way is to take them up with the forceps as they present on a projecting point of the tumor by small portions at a time; to cut them off successively with the knife, and renew this manœuvre as long as the sac continues concealed. The director carried upwards and downwards through this species of aperture as far as the extremities of the wound, allows us to incise them with safety with the straight bistoury or scissors. No one will now pretend to tear them with the sharp pointed probe of Le Dran, or the gum lancet which was used even in the last century. It is on approaching the sac that the difficulties begin. In some subjects, or in certain hernias it is separated from the skin only by a very thin layer, in others it is found at several lines and even several inches in depth. To arrive at it, we are sometimes obliged to pass through several lardaceous layers, imposthumated lymphatic ganglions, and circumscribed or diffused purulent collections; in fine, it may be immediately surrounded with some considerable quantity of blackish serosity (of which Mr. Travers and M. Richerand each give an example), very apt to make us think that we have penetrated its interior, or with different kinds of adipose expansions, which may be easily mistaken for the epiploon.

Interposed adipose layers.—It seems that this last anomaly is by no means infrequent. Saviard reports a case of it. It was also met with in a patient operated upon by M. Lisfranc. I have had myself four cases. If it be true that the error may often be easily avoided, it cannot be denied that it is sometimes necessary to use the greatest caution not to commit it. When the fatty layer covers the whole of the external face of the sac in the manner of a cloth, or when it is even surrounded by a humid, fine, and polished membrane without adhesions, such an arrangement may embarrass even the most skillful. M. Roux himself barely avoided the mistake in 1825, at the hospital of Improvement. After dividing the integuments and several cellulo-adipose layers, he came to a brownish membrane, very distinct from the others, opened it with precaution, and finding it smooth and covered with an unctuous serosity on its interior he thought he had opened the sac. Beneath was seen a yellowish mass, porous, and very flexible, but not an intestine. Fearing that this mass might be the intestine covered with the epiploon, M. Roux took the precaution of

dividing it layer by layer has he had done with the rest. Instead of the intestine, the true sac shortly presented itself, after which there was nothing remarkable in the hernia. The abnormal production does not always surround the whole of the sac. In 1829, a patient, inadvertently placed in the medical wards of the hospital St. Antoine, was sent the next day to my care. Strangulation was then of several days' standing. The membrane which I took for the sac being opened, there appeared a mass composed of two parts, the one globular, dark, and smooth, of about the size of a small egg, situated posteriorly and inwards; the other larger, less dark, knotty, and placed against the anterior and external half of the first. The idea of an entero-epiplocele immediately struck me. But in attempting to insulate the fatty portion in order to proceed to the reduction, I perceived that the intestine was not laid bare and that a semi-transparent lamina still separated it from the other tissues; this was the real sac, the neck of which gave attachment by its external face to a true fatty hernia which I excised. A laundress, to whom M. Forget called me, presented an arrangement not less singular. I had also opened a membrane which might be mistaken for the sac. The tumor it contained was trilobed, and its three lobes were of unequal size and a very deep brown color. We readily discovered that the viscera had still another covering to be divided. The internal *bosselure* alone belonged to the intestine, it had a particular sac; the two others had also a distinct covering, were pedunculous, of an adipose nature, and fixed to the external face of the herniary peritoneum. I excised them after reducing the intestine, and the patient got well. I operated at La Pitie in October 1831, on an old woman who presented an arrangement exactly similar to that in the first case. These fatty vegetations may assume a thousand other forms. Thus M. Tartrie met with a hard oblong tumor, which he could not reduce, and which he took for degenerated intestine, and cut off for the purpose of establishing an artificial anus. The patient died, and lo! the intestine had not been touched. There was not even enterocele; it was an adipose hernia which had been removed.

A *cyst*, resulting from an old herniary sac, or of any other nature, empty, like the one in the patient operated upon at La Pitie by the method of M. Belmas, or filled with fluid, as many authors have observed, may occasion mistakes of another description which every one can conceive; mistakes so much the more easily occurring as the sac itself after being inflamed and transformed into an abscess, may give rise to most of the symptoms of strangulation, as has been said above.

Third stage.—But being once aware of the possibility of so many mistakes, the experienced surgeon will almost always succeed in avoiding them. The sac is unopened as long as there is seen a surface rugose, tomentose, uneven, a mixture of layers or lumps, adipose, vascular, cellular, or lamellated; as long as the neck of the tumor is not free and does not allow us to feel around its circumference within the ring with the nail or the end of a probe. Cysts, abscesses, &c. are distinguished by their want of communication with the abdomen. It is the same with all morbid productions situated without the peritoneum. Supposing, besides, that an adipose layer may be mistaken for the epiploon, what danger would there be in tearing it prudently in order to see what is beneath? Unless there are peculiar difficulties, we ought only to lay bare the sac in the direction of the wound of the integuments. By trying

to dissect it, and separate it carefully from the surrounding tissues, the surgeon prolongs the operation, increases the amount of pain, and renders mortification of the process of the peritoneum almost inevitable, if its excision is not immediately performed. In the more simple hernias, the opening of the sac is easy and without danger to the man possessed of exact anatomical knowledge and a little skill. The intestine constantly presents some inequality and is not so exactly globular as its peritoneal covering, which besides is usually separated from it by a layer of serosity or liquid matter of more or less thickness. In this case we may in some measure, as Louis did not hesitate to affirm, cut at a single stroke the skin and the principal layers which separate it from the sac, and then with a second stroke without hesitation penetrate this last envelope. In other and rather complicated cases, this proceeding would amount to rashness, and would truly deserve the blame which has been cast upon it. When there is in the sac but a small quantity of fluid, it does not prevent us recognizing the presence of the intestine within. What may lead to error is the entire absence or the excess of fluid in this pouch. It is readily perceived how easy it would be on the first hypothesis to cut as deep as the viscera, and divide them without perceiving that we had passed the sac. The difficulty would be in every respect much greater if the various parts were united by adhesions. In the second case the danger only lies in the possibility of confounding it with a large portion of intestine distended with gas or any liquid substance, supposing here that the sac could not yet be distinguished.

Dropsy of the Sac.—The presence of a large quantity of fluid in the sac is too frequently met with not to require notice in this place. An observation of Saviard mentions it. Merry found more than a pint in the case of a woman. M. Liegard of Caen, and M. Roux, have each met with a case. Schmucker and Siebold are said to have been on the point of being deceived, and of supposing that they met with a hydrocele. Monro asserts that he found more than six pounds, and Scarpa more than three in a single sac. Pott several times tapped for this complication, which Mr. Lawrence appears also to have met with. In fine, in a thesis which he has just defended. M. A. E. Marechal has assembled several cases, picked up by him at La Charite. In order that it should occur, too conditions are necessary; the neck of the sac must be first closed by stricture or in some other manner, and then the peritoneal process must become the seat of an unnatural exhalation. The other affections which may to a certain degree simulate it, are vesical hernia, an hydrocele which shall have an old closed hernia sac for its seat as witnessed by Butrandi and Pelletan, or large hydatic cysts developed on the strangulated epiploon, like the one mentioned by Lamorier. I have myself observed a case perhaps more extraordinary still than any of those as yet related; an old man quite robust was brought into my ward at St. Antoine in October 1828, to be treated for an enormous hernia, attended for five days with constipation, vomiting, and other symptoms of strangulation. This hernia which occupied the scrotum had double the size of the head of an adult, was heavy, tense, brownish, slightly painful, covered with veins gorged with blood, and had no crimpling on its surface. Fluctuation in it was obscure, so thick were its parietes, and the light of a taper gave but very vague indication of its nature. The patient told us he had carried it for fifteen years without its being larger than his fist,

and that several times he had succeeded in reducing it. I did not hesitate to open it, proceeding with the same cautions as for ordinary hernia, that is, dividing its coverings layer by layer, and on one point only. As soon as it was pierced there escaped with a forcible jet a liquid as clear as wine. I immediately enlarged the opening and drew off more than three *litres* of a slightly turbid serosity. Its superior part contained besides an entero-epiplocele about as large as the fist, which was powerfully strangulated, and had several gangrenous spots. By calling to mind the natural signs of simple hydrocele and cystocele, there will be but few difficulties on this head. The mistake, besides, would not be very serious. It is only necessary to know that such a complication would render the efforts of the taxis nearly useless, since the fluid absorbs them before they reach the intestine; and on the other hand this fluid must favor the strangulation by its reaction upon the viscera. It is then as in every other case, the intestine with which we should be careful not to confound the sac thus filled with fluid. In order that it shall be impossible, we must suppose an intimate adhesion between these two parts, a kind of confusion of the visceral peritoneum with the parietal peritoneum of the tumor, which except in very old or cœcal hernias is quite rare.

Provided there is no sac, even when adhesions may exist, it does not appear how it can be absolutely impossible to recognise the intestine if proper care be used. The sac in its natural state is but a simple *lamella* and can only be surrounded by *lamellæ*. Whatever thickness it possess, whether depending on the cellular tissue which covers its surface, or on accidental layers deposited on its internal face, it will always be presented under the form of concentric layers unequally superimposed; while the meeting with a fleshy covering with a double plane of fibres beneath a completely adherent serous expansion will not permit us to mistake the intestine, nor to penetrate the interior of this organ if we wish to avoid it. A note by the translator of Scarpa, in which it is said that a provincial surgeon divided the intestine, because the adhesions which united it with the sac did not permit him to distinguish these two parts, the accident which happened the last year in one of the great hospitals of the capital to the superintending surgeon, who also penetrated the intestinal canal in operating for a hernia, as well as many other mistakes of the same description, seem, it is true, to rise up against the opinion I have just advanced; but viewing it more closely, setting aside the authority of names, and with the desire of coming exactly at the truth, we shall not be long in perceiving that the error in these different cases was not inevitable, and that the blame should be attached rather to the inattention of the operators than to the nature of the case. The practitioner mentioned by M. Olivier, for instance, says that before arriving at the sac, he had to pass through a cyst filled with brownish serosity. But it seems evident to me that this pretended cyst was the sac itself which he did not recognise. Hence it is that he opened the intestine thinking it only the herniary covering. However this may be, we may proceed in two ways to the opening of the sac. The first, and that which is generally followed, consists in seizing it with the forceps at the point which seems most free, so as to raise a small flap, which is excised by carrying the bistoury horizontally beneath the beak of the instrument. The fluid, if it contain any, immediately issues through this opening, unless the intestine is immediately engaged in it, which is distinguished

by its greater pliability, by its more mellow appearance, and its other natural characters. A conductor, carried through this opening, is then used in enlarging it as much as is desired, and protects the viscera against the action of the probe-pointed bistoury or blunt scissors which are then to be employed. The other method is apparently more dangerous, and hence is generally condemned by authors. But I have constantly found it more simple than the preceding, and would therefore not hesitate to give it the preference if we could rely sufficiently on the hand of every one who operates for strangulated hernia. While the left hand stretches sufficiently the sac or tumor, the right, armed with a straight bistoury held as a pen, draws gently and with small strokes the point of the instrument over the prominent parts, divides them layer by layer, and thus allows us to distinguish all the laminæ which present, to stop when we please, and to penetrate quite as safely as by the ordinary process. In every case, the rule is to open the sac as far as the lower part of the tumor, so that its inferior portion may not serve as a receptacle for pus or other fluids that may accumulate in the bottom of the wound. Many surgeons advise the same to be done at the superior part; but others, of a different opinion, direct the incision to extend only to within a certain distance of the ring. They contend that by this they expose the patient less to peritonitis, or the surgeon to go wrong in removing the stricture, provided that then it becomes impossible to introduce the bistoury between the neck of the serous tunic and the aponeurotic opening, as, it is said, has sometimes happened. If names such as J. L. Petit and Astley Cooper were not their defenders these operative minutiæ would not deserve notice. Has the question been seriously discussed whether it is proper or not to prolong a few lines more or less the incision of the sac, in this or that direction? Those who have performed the operation for strangulated hernia cannot be made to understand that the removal of the stricture can be rendered either more or less easy, or peritonitis either more or less to be dreaded by one or the other of the modes of proceeding. When the root of the parts to be reduced has been laid bare, the object is accomplished. For the rest, it is of little consequence whether the incision of the peritoneal process extend into the ring, or stops a few lines short.

Fourth Stage.—Freed from every obstacle to their expansion, as soon as the sac is largely opened the viscera often suddenly acquire a much more considerable volume than had at first been supposed; so as even to lead to the belief that a new portion of them has just escaped through the herniary opening. At length they are in view. Before going further, we must appreciate their condition and ascertain the seat of stricture. When the hernia is not very large, inflammation has often united its several folds together or to the sac. Gentle traction or passing the fingers between the parts is always sufficient to separate them in such cases. If old adhesions organised, filamentous, in form of chords, or cellular prolongations, prevent their complete insulation, a bistoury or scissors will soon despatch the business. General adhesions, so intimate as not to permit us to perceive any line of demarcation between the sac and the hernia, should alone be respected. In attempting to destroy them it would be difficult not to make some slips in the direction of the intestine; or if, to obviate this danger the instrument is carried more outwards, the viscera remain loaded with too much foreign tissue, rendering their reduction

doubtful. If they are strangulated by a rent in the sac, or in the sac itself, by a rupture or band of epiploon by an accidental cord, or in any other way, we begin by setting them free in order to spread them out and see if they are not the seat of a degeneration, whether ulcerous or gangrenous; in a word, to see whether or not they are in a perfectly sound state. Having thus spread out and examined them, we should replace them in the abdomen if the stricture of the ring offer no obstacle. In fact, this is possible in a certain number of cases. In the first place, when the abdominal opening is not the seat of strangulation, and when besides, the course of the matters has not been interrupted by a too abrupt inflexion of the organs on the herniary orifice, moreover when the substances accumulated in the intestinal loop, are of sufficient fluidity for a methodical pressure to return them behind the ring. Nevertheless, before attempting it, whatever be the state of the parts, all that portion should be drawn out which is found in the aponeurotic passage. Without this precaution we run the risk of returning into the abdomen a portion of intestine, constricted, obliterated, ulcerated or more or less extensively altered, which although seeming perfectly sound externally, may be absolutely incapable of performing its functions. Besides, another advantage results, which is, that the loop being longer, the matter it contains are spread over a greater surface, distend it less, diminish the volume of each of its rings, and thus render its reduction more easy. Its coarction in the ring is a known fact, admitted by all authors, and which the observation of Ritch has placed beyond doubt. In a patient operated on by this surgeon, the symptoms continued after the reduction. Death was the consequence, and the opening of the body showed the cause; the portion of intestinal tube which had been strangulated, was found so contracted as scarcely to allow a passage to a common quill. A more frequent lesion, and one which in my opinion has not been sufficiently noticed, is *ulceration of the intestine* on its external face. It presents the appearance of a furrow, one to two lines broad, occupying sometimes several points, sometimes even the whole extent of the intestinal circumference, and corresponds to the fibrous circle which has caused the disorder. It might be called a wound produced by a cord tied too tightly. As long as the peritoneal tunic alone is deceased, as the muscular membrane is not entirely cut through or the mucous membrane preserves its thickness, the whole may be replaced in the abdomen without danger; but then the greatest care will be necessary, for these various tunics being at the same time more or less softened, the least pulling may terminate in a rupture, as I witnessed in the case of a female operated upon under the direction of M. Roux, and who died the next day. Mr. Lawrence and M. Roux, who with more earnestness than M. Boyer have called the attention of practitioners to it, might have added that this traumatic fissure has more than once gone so far as to perforate the intestinal tube and produce a fatal effusion, the origin of which was improperly referred to gangrenous ulceration. A woman fifty-five years old, was brought in 1824 to the hospital of Improvement. I operated immediately for a strangulated hernia of forty hours' duration. After removing the stricture, I reduced the intestine with the exception of its most projecting part which was gangrenous, the opening of which I retained in the ring. The organic contour which had supported the constriction, presented the above-mentioned ulceration, and near its mesenteric border, there was a perforation

through which the fluid matter poured into the peritoneum. The reduction therefore should never be accomplished in any case without previously bringing the sac, for examination, that portion of the viscera which has been originally contained in the fibrous circle of the abdominal wall. If it resist, or any difficulty be experienced in returning it, we should without hesitation enlarge the opening through which it has passed—we should finally remove the strangulation.

Fifth Stage.—The seat of this strangulation, is not in every case the same. In the circular openings it may be produced by the neck of the sac, or by the fibrous circle which embraces it. In a canal, it is found, as I have already stated, sometimes at the external orifice, sometimes at the posterior orifice, and at other times between the two. Strangulation by the neck of the sac occurs only in old hernias, or in those which have protruded and been reduced a number of times. In other cases, in fact, we cannot conceive how the circle can be thickened, contracted, and indurated so as to interrupt the passage of intestinal matters. It is known by the mobility of the peritoneal prolongation, which is pushed back in drawing the intestine towards the abdomen by the freedom of the ring, notwithstanding the constriction of the viscera, and by the facility of introducing the finger completely or in part between the fibrous circle and the root of the sac. If the strangulation is formed by the external orifice of the herniary canal, the nail carried on this point will soon give assurance of the fact. When more deeply situated, on the contrary, the opening in question is neither tense nor completely filled. In this case, it will be known that the entrance of the serous membrane is not the cause, but rather that of the aponeurotic canal, if the incomplete reduction of the intestine is not accompanied with a gliding of the sac.

Two different methods have been proposed for removing the stricture, *dilatation* and *incision*. The former was extolled by Thevenin, and afterwards by Arnaud, and has been especially recommended by Leblanc. Various instruments have deen devised to accomplish it. The double gorget, the two branches of which open and close in the manner of dressing forceps, will certainly fullfil the intention better than any crotchets or dilators that have been contrived, if the method itself deserved to be retained; but the only advantage it presents, that of defending the vessels from lesion, is of too little value in comparison with its disadvantage to allow its general adoption. The impossibility of applying it when the strangulation is carried very far, its insufficiency in the greater number of cases, the contusion of the viscera which most frequently results from it, the enlargement of the ring instead of its definitive closure, which will almost necessarily be the consequence, sufficiently justify, in my opinion, the neglect into which it has fallen; and I doubt whether M. Truestedst, who, alarmed by the fear of opening the arteries in removing the stricture, has just proposed it anew, will find many imitators among his contemporaries.

Incision or *debridement* consists in dividing more or less deeply, on one or several points, the free edge of the constricting circle. This is the delicate and dangerous part of the operation. It exposes the organs within the ring to be wounded, and even those still contained in the abdomen, but especially the vessels on the contour of the hernia. On this account a host of different processes have been advised for executing it. The scissors curved on the

edge, formerly used by some, are proscribed at present and deservedly. It is the same with the bistoury of Bienaise, an instrument which seems to have given the idea of the lithotome of Frere Come. The concave bistoury of Pott, now supersedes all other herniary bistouries. Sir A. Cooper has so modified it, that its cutting edge is not more than six or eight lines in extent, and stops within two or three lines of its buttoned extremity. Thus constructed, it renders less liable to lesion the parts which during the cutting of the stricture come before its heel. This trifling advantage should be accepted, but we should be cautious in exaggerating its value, as has been done by some of our masters, no doubt from want of reflection. I will remark here, that in certain cases when the edges of the abdominal opening are very thick, when movements *backwards and forwards*, or sawing movements become necessary, it is less convenient than the bistoury of Pott. The oval plate which M. Chaumas placed on its convex edge, in order to protect the intestines, is too much in the way and of too little use to require further mention. The intention of M. Dupuytren in transferring the cutting edge to the convexity, which seems not to have been exactly understood by those who have written since, was to render it better adapted to the division of the tissues, from before backwards, and from the centre of the ring towards its circumference. Hence it is suitable only in some cases, and we shall soon show that even in these cases the simple straight bistoury, or the ordinary convex bistoury, may be used advantgeously in its stead. The probe-pointed bistoury, edged like a file, invented by J. L. Petit, is too coarse to divide the vessels, but will be fine enough to destroy the continuity of an aponeurotic circle, but is of no value notwithstanding all the eulogies that have been heaped upon it. The stricture is not always caused by the fibrous tissues, and it is not proved that an instrument just capable of cutting an albugineous circle will always spare the tissue of an artery. As to the common probe-pointed bistoury, it is evidently less convenient than the curved bistoury, as we are almost always obliged to follow a passage more or less tortuous to come at and remove the stricture.

The winged director of Merry which the invention of M. Chaumas should render useless, and which was intended to fullfil the same indication, is no longer found in the apparatus of surgery; so that Pott's bistoury is in reality the only particular instrument that has been retained for relaxing the stricture in strangulated hernia. When there are no vessels in danger, the concave bistoury or even the probe-pointed bistoury, if a ring and not a canal is to be acted upon, suffices and may be preferred. The nail of the left index finger is first introduced between the intestine and the circle to be divided, its pulp then serves as a guide to the instrument of Pott, the bottom of which is carried into the abdomen before turning its edge upon the resisting border. An assistant then takes charge of the viscera, and separates them from the point to be divided; another assistant acts in the same manner with respect to the lips of the wound; after which the surgeon, combining the movements of his right hand which holds the handle of the bistoury with those of the left index finger which supports its back, saws the ring until it yields and is decidedly cut, which is told by a sound similar to the breaking of tin or the rumpling of parchment. However, as this noise comes from the fibrous tissue which is broken, it would be useless to expect it when the unbridling cut acts only on the neck of the sac. Supposing the director is to be used, it will be as a sub-

stitute for the index finger; that is, after it has been introduced into the peritoneum the bistoury is passed upon it, and thus supported during the cutting of the stricture. In such cases it is well for it to have a cul-de-sac to serve as a limit to the point of the cutting instrument, and to have it curved so that the concavity of its beak may be well applied against the internal face of the abdominal wall, and prevent any portion of the viscera from coming between, and running the risk of being divided at the same time with the edge of the herniary opening. If it is absolutely necessary to be content with a straight or sharp-pointed bistoury, all these precautions no doubt have their value; but with Pott's, or any probe-pointed bistoury, where can be its importance? Are they not more embarrassing than really useful? To preserve with certainty the vessels about the neck of the sac, Bell has recommended a very ingenious process, which is this; a convex or broad-pointed bistoury, as most of the English ones are, with its back against the pulp of the left index finger, is carried in front of the ring and divides it at short strokes, fibre by fibre, from below upwards, or from the centre towards the circumference, and from its cutaneous face towards its peritoneal, taking care that the edge of the nail always goes a little beyond the point of the instrument. The strangulation is thus removed before arriving at the *fascia propria*, which contains the arterial canals, and nothing forbids the incision to be carried to all proper extent. It was evidently to obtain an analogous result that M. Dupuytren proposed his curved bistoury with the edge on the convexity. This process, the advantages of which I attempted to demonstrate in 1825, which M. Colson, and M. Dellouey have introduced again as belonging to themselves, is in the first place only adapted to a strangulation foreign to the neck of the sac; secondly, it would be impossible or dangerous to have recourse to it when the circle to be divided is deeply situated or not well determined. For the rest, the most common convex or slender-pointed bistoury will answer the purpose equally as well as the bistoury of Bell. Moreover, the danger of wounding the vessels is much less than is generally imagined. Enveloped in cellular substance which lines the peritoneum and separates it from the *fascia transversalis* or the abdominal parietes, they are constantly thrown outwards, two lines at least, upon the posterior face of the ring, and this is because the entrance of every hernia is widened into the shape of a funnel, and by entering it the viscera themselves separate more or less the vessels. On the other hand they are so flexible and generally so movable as to recede from the bistoury when it touches them, rather than remain and be divided by it. When the strangulation occupies a canal, and is not located at its posterior part, the necessity of carrying the point of the instrument into the abdomen is not evident, nor consequently is it evident in what consists the danger of wounding the blood vessels. In fact there is another means of braving every inconvenience of this sort with almost complete security when we are obliged to pass through the whole of the herniary passage. This consists in making two, three, four, five, and even ten incisions, instead of one, upon the dense margin which binds the viscera. By thus multiplying them we can give to each but a line or a line and a half of depth; the enlargement of the orifice will yet be considerable, and the vessels will be absolutely out of danger. The idea of this process, which I shall call the "*debridement multiple*," is already found in Scarpa, and has long since received its application in vaginal hysterotomy.

M. Manche of Lyons published it in 1826. It seems that M. Dupuytren adopts it also in some cases. But it was by M. Vidal (of Cassis) that it was erected into a rule in 1827, and 1831, at the same time that M. Dellouey who, no doubt by mistake, gives the honor of it to M. Amussat, proposed to combine it with the method of Bell. For my own part, I have performed it three times, and am led to believe that it deserves the serious attention of the operating surgeon.

What extent should be given to the debridement? If we trust some authors, two or three lines will be sufficient. According to them, a more extensive incision, by enlarging the ring too much, will most assuredly cause a relapse, even when no wound of the vessels is apprehended. No doubt we should be content with a small incision when the constriction is trifling and the reduction does not require more. On the contrary if there seems to be a necessity for a larger incision, the practice of Sharp, of Hey, of M. Dupuytren, and the observations recently published by M. Janson, prove that there is no reason for abstaining from it. The incision of two lines in extent, repeated in several places, the *debridement multiple* will leave no excuse on this point to those whom the vicinity of important vessels might deter. As to relaxation of the herniary opening, it does not appear how it can be very formidable, unless on the supposition that it is one of those long gashes which cannot be indispensable except in some rare cases of deep strangulation. If the wound suppurate, as it almost always does, the inodular tissue which is formed in front, or even in the centre of the ring, to constitute the cicatrix, frequently offers to the viscera a more powerful resistance than could have been presented by the natural tissues. In this point of view the *debridement multiple* should still obtain the preference, because the more numerous the scarifications of the ring the more solid will the cicatrix become, and the greater will be the chance of seeing the elastic tissue in question developed.

Some authors have also thought, that it would be advantageous and possible to remove the stricture without opening the sac; that thus there would be an operation attended with very little danger, as the peritoneum remaining intact would not be so exposed to the inflammation which is so frequent after the common operation; that the viscera would by this mode be out of danger of being wounded; in a word, the opening of the sac, which is ordinarily attended with so much uncertainty would be avoided, and celotomy performed with confidence, promptitude, and very little pain. Of itself the cutting of the stricture thus presents no more difficulty in this way than the ordinary process. The bistoury is introduced between the fibrous ring and the neck of the sac instead of being passed between the sac and the viscera; the root of the hernia is insulated with a little more care, in order the better to distinguish the external face of the serous prolongation at its exit from the abdominal aperture, and this is all. J. L. Petit, who set himself up as the defender of this mode of operating, to which Franco, Rousset, Pare, and some others, had already called the attention of practitioners, attributes to it, as has since been done by Garengeot and Ravaton, so many advantages that no other would at present be followed if they were real and not counterbalanced by still more numerous disadvantages. It is time in my opinion to cease to attribute to the contact of the air, dangers which are so often encountered without any plausible reference to such a cause. The radical cure which is pretended to be thus

obtained, is certainly less probable than by the opening of the sac. If the hernia is reduced without dividing its peritoneal covering, it does not appear how the obliteration of the passage is a necessary consequence, as it is maintained to be by J. L. Petit. It is to be feared that the parts contained in the the sac may be the seat of alterations, which it is important not to mistake. To what accidents will the patient not be exposed if the intestine be gangrenous, ulcerated, contracted, twisted, strangulated by a band, passed through an opening in the epiploon, or if several of its parts adhere together. It is evident, moreover, that in case of adhesion, reduction would be altogether impossible, and that this species of liberation would be insufficient, whenever the stricture is caused by the neck of the sac. Add to this, the serosity more or less turbid of a deeper or lighter red, which may be found in the hernia to the amount of several ounces or even pounds, as has been noticed above, could not be returned into the abdomen without creating apprehensions. This method, which may perhaps be successfully put in practice, for recent and small hernias, presents therefore no real advantage over the ordinary method, and deserves the neglect into which it has sunk, notwithstanding the successes brought forward in its support in the name of M. Beauchene and of some other modern practitioners, who seem to consider it of their own invention. Another species of *debridement*, which seems to be as old as Franco, is that advised by Pigray. It consists in making an incision in the abdominal parietes a little above the strangulation, so as to be able by introducing the fingers into the wound, to draw back the intestine and return it into the abdomen. Rousset who wrote a little before Pigray, says that this mode had been followed by Duval and his son, as well as by Maupas. Heister who refers it to Cheselden, is evidently mistaken on this point, as Sabatier judiciously remarks; the process of the English surgeon appears to be the common one, but with a very large incision. It is sufficient, I think, to mention the operation spoken of, to show its dangers and absurdity. If after incising the anterior ring of the herniary canal there be any difficulty in the reduction, it will be necessary to explore this canal with the finger, and see that no second strangulation exist on the side of the abdomen. If in this case the stricture depend upon the sac, we may, by drawing the two lips of its external division, bring it in the wound and divide it without danger, with blunt scissors or a bistoury, to any necessary extent. When on the contrary this posterior strangulation is caused by a fibrous circle. the drawing out of the neck of the sac will be insufficient; the curved bistoury must be introduced, guided by the finger or a director, and be used as in external strangulation.

Sixth Stage.—The obstacle which opposes the return of the displaced organ being overcome, the next thing to be attented to is the reduction. After spreading equally all the matters contained in the intestine which is visible, the surgeon grasps it with the thumb and the first two fingers near the ring; the right hand embraces the portion last issued and pushes it back, passing it between the fingers of the left, which prevents its return, while a new portion is seized and reduced in the same manner, and so in succession until the whole is returned into the abdomen. The fore finger is then carried into the canal, to be certain that the intestine has resumed its natural place, that it has not turned through the substance of the abdominal parietes, that the sac has not followed it, and that it is really free from all stricture or adhesions capable of

interrupting its functions. When there remains a strangulation at the posterior part of the sac, which has formed but very feeble connections with the parts adjacent, if the hernia is not very voluminous, it may return *en masse*, by pushing before it the circle which strangulates it. Le Dran was one of the first to point out this fact, which has been taught by many surgeons since. The intestines then glide between the peritoneum and the parietes of the abdomen, sometimes are arrested there and become fixed. The stricture not being destroyed a fissure is at length made, and then follows an effusion into the abdomen. Arnault, De la Faye, Leblanc, Bell, and Sabatier have observed cases of this description, and M. Dupuytren seems to have met with several. It is not always in consequence of resistance of the neck of the sac that the hernia thus returns without ceasing to be strangulated. If the strangulation is situated at the internal aperture of the canal, and has not been removed, the intestines may also be engaged between the fascia transversalis and the muscles, separating these parts, and remain there quite as well as it might between the aponeurosis and the peritoneum. An adult, twenty-eight years old, upon whom I operated for an enterocele, presented this peculiarity, in 1823, at the hospital of Improvement. After freeing the external aperture of the canal, I forgot to explore the posterior ring, and passed to the reduction. As I had heard no gargouillement, and as the abdominal wall remained projecting, I determined to carry my finger as far as the interior of the peritoneum, and then discovered that the reduction was incomplete. The intestines were brought out again; and the left index finger carried to the bottom of the wound, soon afforded me the certainty of a second strangulation, which was produced by the inner ring. I removed the stricture, and the reduction presented no further difficulty.

It is therefore necessary to distinguish the return of the intestines between the peritoneum and the aponeurosis, from that which takes place between the aponeurosis and the muscles, or the different muscular layers of the abdomen, and not to confound the obstacle depending on the neck of the sac with that which arises from a stricture in the posterior ring. When such an accident happens, the first thing to do is to reproduce the hernia. This is accomplished by directing the patient to cough, to bear down, and even to get up.—Frequently however the viscera come out again spontaneously. When they can be reached with the finger it is still better to take hold of them and draw them outwards, using all proper precautions. If the difficulty arises from the neck of the sac, tractions upon the portion of this covering which remains in the wound will frequently prove an excellent means of attaining the end proposed, as has been proved long since by M. Dupuytren. However, neither of these resources will constantly insure success. Chopart, Lobstein, and other experienced practitioners have seen their patient sink for want of this reproducing of the hernia. There is another circumstance which sometimes opposes to the immediate return of the organs into the abdomen; it is the case in an old and voluminous hernia. Having accomplished the reduction of a tumor of this kind with much difficulty and fatigue, J. L. Petit found the symptoms to continue, and only cease when the viscera were permitted to descend. He explains the fact, by saying that the abdominal cavity was accustomed to the absence of the organs; and so contracted as no longer to allow them admission, so that they had lost as it were the *right of domicile.*

When the extensibility of the parietes of the abdomen is considered, when in the same day they permit the stomach and other entrails to acquire double or triple the dimensions they previously had, it is difficult to believe that their resistance alone is of a nature to render the reduction of any hernia impossible or dangerous. Is it not more probable that in the environs of the neck of an old and voluminous hernia, adhesions are established between the organs so as to render their displacement difficult, or rather that the viscera being a long time displaced cause unpleasant symptoms to occur, because after the reduction they remain compressed, agglomerated, united into a mass, and do not freely spread behind the ring? This reflection, which long since occurred to me, which has also been made by M. Curveilhier, and which Petit the younger does not forget, deserves in my opinion some notice. For the rest we should not go so far as to deny absolutely the explanation of J. L. Petit, which really applies to young and vigorous subjects whose abdominal parietes are endowed with great elasticity, and are of considerable thickness, to those of a certain *embonpoint*, and in whom the epiploon is loaded with fat. On the whole, it would be better to leave the intestines within the sac after freely incising the stricture, than to bruise and injure them by attempting their reduction. Experience has shown, that being thus kept without they in the end insensibly return, if not entirely at least for the greatest part. The horizontal posture, the debilitating regimen to which the patient is confined, creates by degrees in the abdomen a kind of void, which singularly promotes the effect intended. Before declining the reduction we should give it a second examination. There are a number of alterations for which the return of the parts into the abdomen would indisputably be the best remedy. Thus concentric ulceration should not prevent it, if confined to the external membrane or even to the muscular coat; if in a word, it does not completely perforate the intestine. A coarctation of the displaced organ is not always a counter-indication. If it be recent and moderate, leaving to the alimentary canal at least half of its natural dimensions, it may be expected finally to disappear, and the cure will probably be advanced by replacing in the abdomen. Gangrene is a condition which most decidedly opposes every attempt at reduction. But for the same reason we must not be deceived by appearances. If the strangulation is acute, and there has been inflammation, and the symptoms have lasted sometime, the intestine contained in the hernia is more or less red. Frequently it is found of a dark or greyish brown, with the peritoneal coat separable in small flakes, having lost its smooth and moist appearance and become wrinkled, and all this without the existence of gangrene. The fetid odor or presence of fecal matter which some persons have given as characteristic signs, may also occasion mistakes. The same remark applies to the slate-like, or grey cinereous tint. If its tunics are not sunken, flaccid, and folded as it were upon themselves, if it resists the tractions made upon it, if it remains dense and shining, if the thickness of its parietes seems to be increased instead of diminished, if it preserves some warmth, and this warmth remains equal on every point after being exposed sometime to the air, if it is not the seat of any perforation, there is no gangrene. When intimate adhesions, which cannot be destroyed, are encountered, it is not the less necessary to make the *debridement* as in ordinary cases, only it is proper to make it a little larger in order afterwards to return the free portion of the viscera.

The rest is left in the sac, which is covered with compresses soaked in some bland fluid, as in the case of large irreducible hernia. When freed from the constriction of these parts, the organs, being drawn upon by those of which they are a continuation, often in the end return of themselves, or at least form within the ring but a small tumor, which a concave pad will easily support after the cure.

B. *Epiplocele.*—We have as yet scarcely noticed any but intestinal hernia. Epiplocele existing by itself is rarely so strangulated as to require a removal of the stricture, but it is very common to find in the same sac a loop of intestine and some considerable portion of epiploon. In this case it is proper, before cutting the stricture, to see if the opening has not contracted a union with the neck of the sac or around the intestine. It is also proper to make the incision on a point not occupied by the epiploon, so as not to expose to division any of the vessels, sometimes very large, which run through this expansion. Although it usually presents first on opening the sac, yet the reduction must begin with the intestine after the removal of the strangulation. That of the epiploon is always more difficult. It has almost always undergone some alteration. If it should be fixed in the sac only by bands and filaments it would be very easy to destroy them. When its adhesions are intimate and lamellated it becomes almost indispensable to remove the part. If it have remained long displaced it has become loaded with fat, or transformed into an adipose mass, or reflected upon itself, giving rise to knots, cylinders, and hard shining tumors which have been compared to scirrhus. But a great variety of forms are met with, and it would be almost as impossible as useless to describe them all. If these masses were reduced with the viscera, when they are susceptible of this reduction we might expect that some of them would be resolved, but this would rarely occur; and should they be of any size their presence in the abdomen would be attended with too much danger to allow of the attempt. Excision is without danger when they are pedunculous, as often happens, and when we are not obliged to cut into the sound portion of the epiploon. In the month of April last, M. Payer and myself cut down to an entero-epiplocele in which several of these productions were developed. One, four inches long and from fifteen to twenty-eight lines thick, adhered to the fundus of the sac by an epiploic band, still distinguishable, and was continuous towards the abdomen with the same membrane, by a narrow lamella of so little vascularity that it was divided without the least flow of blood. Another not so long but more enlarged about its middle, which had also a broad root, was removed in the same manner with no more inconvenience. Besides, if their root appears to contain vessels of a certain calibre, nothing prevents their being encircled by a double ligature before removal. Should the epiploon preserve its natural state it is to be reduced, if its return into the abdomen is not attended with too much difficulty. With this intention it is pushed back by degrees, commencing, as far as the intestine, with the part last come out, after it has been freed from all adhesion and every kind of duplicature. When it is irreducible some contend that it should be left in the wound, that it will return little by little, and that a concave pad will support very well the part that may remain without. Excision, which is at first view quicker and more satisfactory, has not as yet been adopted but by a small number of practitioners. There are three modes of

performing it; first, to cut between the dead and living parts in case of gangrene; second, to cut in the living part whether there be gangrene or not, to use no ligature, and reduce it; third, to cut in the living portion and tie separately the vessels as they spring. The first method is bad, because if any mortified tissues remain, their return into the abdomen could not fail to be dangerous, and if the bistoury touch upon the yet living tissues a hemorrhage might be the consequence. The second has been defended by Caque of Rheims, who gives nine successful cases in its favor. With this author I am convinced that ligature of the epiploic vessels is not always indispensable, and that often they will cease to bleed after a certain time. Nevertheless I would not dare to propose his practice as an example to be followed. I conformed to it once with a patient of M. Florence. Until then the operation presented nothing peculiar. It was necessary to remove a part of the epiploon. The vessels at first scarcely bled at all. I made the reduction, and in the night a quantity of blood flowed from the wound. Syncope, and lipothymia accompanied with cold sweats supervened, and although the vomiting had ceased and the matters resumed their natural course, the woman died ten hours after the operation. This was sufficient to make me resolve not to run the same risk in future. The third is the mode followed by M. Boyer. To perform it, the surgeon begins by displaying and unfolding the epiploon, so as to have but one *membrane* to divide; he then cuts off with the scissors or bistoury all he intends to remove, seizing each vessel as it springs with the forceps, and tying it immediately. This done nothing remains but to push the preserved parts behind the ring, and bring all the ends of the ligature together to one of the sides of the wound. The disadvantages of this operation are, the time required, the minute search for the vascular canals, and the probability of omitting some of them, which in the end may give rise to danger. This is however the most worthy of confidence, and indeed the only one that ought to be adopted when it has been decided that nothing is to be left in the wound, and the parts are to be entirely reduced. In this case however it would be proper to introduce an important modification. The ligatures, in fact, will not permit the epiploon to be left behind the heniary opening, but will oblige it to be left in the wound. Torsion of the arteries, which is easily performed in this case, would supply their place advantageously, and ought to be substituted. I have twice employed it, and I think that without it my operation would have been less simple.

The ligature, for a long time in use, mentioned even by Galen, has during the last century been the object of numerous attacks. J. L. Petit among others accuses it of causing dreadful dangers. A patient thus treated was immediately seized with colic, violent pains in the abdomen, and nervous symptoms; and it was not known to what to refer them. The surgeon removed the dressing to see if the intestine had not redescended. Finding nothing of this sort he took away the ligature, and all the symptoms vanished as by enchantment. From this and other facts it was concluded that stricture of the epiploon was almost as formidable as that of the intestine. Theory, always ready to come to the support of suppositions arising from practice, seemed to account for the phenomenon, by showing that the great sympathetic nerve distributes a certain number of filaments over the whole extent of the epiploic expansion Pipelet says, that the danger arose only from the con-

striction rolling into a cord a membrane that should remain expanded, and the opinion of J. L. Petit has thus passed into an axiom. However, as the ligature is much more convenient, and more easy of application, and protects from hemorrhage quite as certainly as any other mode, some practitioners have not been willing to renounce it entirely. Hey, for example, and Scarpa maintain that they removed its inconveniences, without destroying its advantages by means of a very simple modification; the first applied the ligature after the manner of the ancients, but tightened it only by degrees so as to strangulate and produce mortification of the organ only after several days, instead of suddenly intercepting the circulation; the second leaves the epiploic tampon in place until it is covered with cellular granulations, and then strangulates it after the manner of Hey. The cases reported by these authors in favor of their practice prove its harmlessness, and leave no doubt that it ought to be preferred if the ligature *en masse* is to be dreaded as much as Petit imagines. Happily it is not so, and on this point we may appeal to the judgment of the academy of Surgery. I have already had occasion to tie the epiploon four times, and the four patients got well without any serious symptoms. When the tumor to be removed does not exceed the size of the finger, it may in my opinion be included without fear in a strong ligature, and completely strangulated at some distance from the ring. On the contrary, when it is larger the root may be divided into as many portions as desired, so as to admit a ligature about each separately. Two were sufficient in the case of a woman on whom I operated in 1829 at Saint Antoine. It was the same in the case of a man operated upon this year (1832) by M. Payen. Quite recently, the 8th August 1831, seven were necessary in the case of a woman upon whom I operated in conjunction with M. Gresely. All without the ligatures is then cut off, and the ends of the ligatures are brought together on one or more points of the circumference of the ring, and the operation closes. To sum up these remarks, if the epiploon is gangrenous, and it is desired to return the sound part into the abdomen, it is best to cut in the living portion and twist the arteries. If the surgeon thinks proper, on the contrary, not to return it beyond the herniary circle, he may confine himself to the separation of the completely mortified parts without using either the ligature or torsion. When it is simply irreducible and still possessed of vitality, and we are obliged to excise it and then keep the rest within the ring, one ligature including the whole, or several embracing each a distinct portion, present the process at once the most simple and the most prudent that can be followed.

On this subject a question arises. Is it better, every thing else being equal, to retain in the ring the epiploon from which the excision has just been made, or to leave it in the abdomen? Fixed in the passage of the viscera, it would contract adhesions, vegetate, become covered with cellular granulations, harden by degrees, and finally blend itself with the cicatrix, so as to render a return of the hernia almost impossible. If returned into the abdomen, it leaves the opening through which it passed entirely free, and in no respect increases the chances of a radical cure. Two motives have prevented the exclusive adoption of the first line of conduct. 1. It has been argued, that the epiploon being once reduced should remain perfectly free, and oppose no obstacle to the various motions of the digestive organs; 2d. an apprehension has been felt that the epiploic expansion might drag painfully and even

dangerously on some of the viscera, and that thus stretched by its two extremities, it might constitute a band or budge, which could become the cause of internal strangulation. A single remark destroys the whole force of these reasons. When it has been returned into the cavity of the abdomen, the bleeding portion of the epiploon neither remains free nor floating: on the contrary it invariably unites with some point of the surface of the peritoneum, so as to induce the same danger as if it had its *point d'appui* in the ring. I think, therefore, that after excision it would always be proper to retain its extremity in the wound. It has at least this advantage, that it is one of the most certain means of obtaining the radical cure of hernia. A number of surgeons go so far as to act in this manner whenever the epiploon, reducible or not, is found in the sac. In reducing it they preserve a pad or kind of stopper which closes the summit of the wound. I have it from Dr. Stevens, the able professor of New York, that he long since adopted this method, and by it has obtained much success. In my opinion, however, prudence does not authorize the practice where the reduction is easy and all the parts are sound. The formation of a band or abnormal septum in the interior of the abdomen is never justifiable when it may be dispensed with, and the fear of bringing on internal strangulation should evidently prevail over the desire of obviating the necessity of a bandage.

Some practitioners have thought that after the return of the whole of the viscera, the sac remaining in the wound should in its turn occupy the attention. Those who with Garengeot direct it to be set free without opening it, thought to insulate it entirely, and agglomerate it in the interior of the ring, where it should be fixed by a pad of lint or charpie. Others have advised to pass a ligature over its neck to strangulate and then excise it. Even in cases where it has been opened in the whole of its length, it was thought possible to reduce it and use it for closing the passage of the hernia. Louis was strongly opposed to all these attempts, maintaining that the reduction of the sac was impossible, and that the adhesions of its external face did not permit the sliding necessary for its accomplishment. On this point Louis was assuredly mistaken, at present there is no doubt on the subject. On the other hand it is extremely probable that being thus pushed back, opened or otherwise, the sac would close the ring firmly enough to present an obstacle to the return of the disease. Excision or ligature would not have the same advantages though exposing to the same inconveniences. If it is necessary in effect, for obtaining its separation, to have recourse to the cutting instrument, there is evidently a risk in some cases at least of wounding bloodvessels or other organs important to be respected. I would advise, therefore, the reduction of the sac whenever it is found almost free, or when its adhesions are weak enough to be broken down without the aid of the knife. It has been thought beside, that after it has been once opened, if we would not or cannot reduce it, it would be useful to cut away its flaps. To this I see no objection, except that it is not applicable to hernias surrounded with large arteries or organs of any importance. Nevertheless if the borders of the sac are so perfectly insulated as to render it certain that they may be excised without wounding any essential part, I see nothing but advantage in doing so. In this way the wound is neater, the suppuration less abundant, and the remainder of the operation becomes necessarily a little more simple.

C. *Dressings.*—The dressing after the operation is reduced to a small matter. A linen rag perforated with holes and spread with cerate is placed over the whole of the new surface. Rolls of simple charpie intended to push this linen to the very bottom of the wound are immediately applied over it. Some dossils of lint then follow with oblong or square compresses, and lastly a bandage adapted to the species of the hernia. Instead of the perforated rag some use a fine linen, without any other preparation Being larger than the wound it serves as a kind of chemise to the charpie, and fullfils moreover the some intention as if it were perforated, but as it does not allow an issue to the fluids, I see no reason for preferring it. Others merely fill the whole opening with msall balls of charpie without interposing the linen, and cover it with dossils of lint, compresses, and the retaining bandage as before. The principal inconvenience in this practice is that it renders the removal of the deeper portions of the apparatus more difficult after the first dressing. Being in immediate contact with the tissues the charpie contracts adhesions, which suppuration does not destroy until after some time, while if a perforated linen separate them we may change and renew all the dressing as well on the second and third day as on the first without giving the least pain. For the rest, nothing is said at the present day of keeping a tent in the ring, nor of keeping in its place a pad of linen or charpie as directed by J. L. Petit. There is now no dissent on this subject, and operators are no longer divided except on the question of immediate union. Franco, who appears to be the first to have attempted to establish as a rule the necessity of exposing the hernia and cutting the stricture in case of strangulation, advises that the edges of the wound be approximated and the suture used to keep them in contact. The greater number of surgeons of that time seemed to have conformed to the advice of Franco. There were none, even to Rousset, Pare, Pigray, and Thevenin, who had not adopted it. It had fallen into neglect however, when about the middle of the last century Mertrud attempted its introduction a secone time, maintaining that the wound in this operation is in the same condition as a simple wound. Notwithstanding the reasoning of Hoin and Leblanc, who adduced a number of facts in its support, it at length fell again into disuetude, as in the age in which it arose. Immediate union however appears to have been attempted by some modern practitioners. The work of Doctor Serre proves beyond dispute that it is in effect possible, by means of the suture, to heal in a few days the wound resulting from the operation for strangulated hernia, and that his able preceptor frequently employed it with success. Professor Berard informed me that he tried it at the hospital St. Antoine, and that his patient got well in six days. On this subject all that is required in my opinion is merely the correct understanding of it. If question is only of the possibility of the thing no doubt that the practitioner of Montpellier is entirely right, but it is the utility of this proceeding which is to be examined. When the hernia is not large, is recent, and its coverings preserve a certain thickness and nearly all their natural attributes, when the sac does not roll nor leave fringes nor shreds to mortify at the bottom of the wound, immediate union may certainly take place in a large proportion of cases. When the tumor has been of larger size, and its covering, more or less attenuated, have become the seat of various alterations, when the sac is quite large and tends to roll upon itself the reduction of viscera, the chance of success is not so great. In this case

it is to be feared that suppuration may be established in the depths of the parts and separate them, to spread in various directions, and cause sinuses, and consequently a state of things that may become very serious. This occurred in the only case in which it appeared to me prudent to attempt immediate union. The hernia was not very large, and the lips of the wound exactly adapted were supported towards their root by an exact and methodical compression. It appeared on the fifth day that agglutination had taken place. But on the next we were undeceived. Swelling, redness, pain, and heat were manifested beneath one of the sides of the division; the inflammation increased, and was accompanied with fever and other general symptoms, which only abated after the opening of a large abscess which was obscurely developed about the inferior angle of the sac. Besides, this immediate union seems to me to conflict with one of the intentions of the surgeon; which should be, to favor as much as possible the radical cure of the disease. If it is incontestable, that the solidity of the cicatrix is greater the longer the wound has suppurated, it is evident that after the operation for hernia, patients have more chances of being radically cured when union of the wound is obtained by second intention than in the contrary case. We may add, that without bringing the divided tissues into perfect contact, it is easy to approximate them a little, and diminish more or less the extent of the raw surfaces, and by keeping up the suppuration obtain a cure in twenty or thirty days. A patient upon whom I operated with M. Amussat, was treated in this manner and his wound was completely closed on the twenty-fourth day. A woman to whom I was called by M. Forget was also entirely restored at the expiration of a month. But I am not sure that after this operation a more rapid cure would be of as great importance as some persons seem to imagine. In conclusion therefore, with some exceptions, mediate union offers the most advantages, and in this place deserves the preference.

The patient, once dressed, is directed to make no effort or motion which may react on the abdominal organs, or if he is obliged to cough, or contract his muscles for any purpose, to apply his hand in front of the apparatus to support it. Without these precautions the intestine may escape again and renew the symptoms. Lassus relates the case of a man who in this condition had the imprudence to leap from his bed and walk several steps. The intestines came out in great quantity, and then reduction was attended with great difficulty. We must not permit ourselves however to be too much alarmed by the fear of this accident. After being returned into the abdomen the intestine does not protrude again as easily as may be supposed. A slight fit of coughing, and the moderate efforts which the patient makes in turning himself in bed are not sufficient to reproduce the hernia. If in consequence of the *debridement* the orifice of the abdominal wall is a little larger than usual, the sensibility already existing in the parts, or that which the inflammation soon produces, forms a kind of barrier which the viscera rarely pass over. It seems as if an instinct prevents them from pressing on this side, and even when he has no thought of it the patient is forced as it were if he makes any movement to prevent it being propagated towards the wound. These remarks appear to me useful, inasmuch as though from prudence we should prescribe rest and immobility to the individual upon whom the operation has been performed, yet there would be this inconvenience, that in not daring to move in one

way nor another, he might consider the slightest movement dangerous. I should also have said that there is no necessity for making the bandage compress the front of the wound, and that a retaining apparatus methodically applied perfectly fulfills the end proposed.

D. *Results and Treatment.*—Except in case of particular accidents the wound should not be dressed until the third or fourth day. It is only about this time that suppuration begins to be established. The dressing is then renewed every day and has no peculiarity. If shreds of the sac, of the epiploon, or any other lamellæ, mortify, they are to be excised immediately. Emollient lotions or chloruretted solutions, and perhaps the decoction of cincona when the suppuration becomes fetid and greyish or the flesh remains dull, and the use of the nitrate of silver if the cellular granulations are developed too actively, may become necessary; but these various applications are called for by the same indications as require them in any other species of wound. When all goes on well, the symptoms of strangulation cease almost immediately. Alvine evacuations are abundant after several hours, and greatly relieve the patient. The pulse resumes strength, and sometimes acquires so much frequency as to indicate a febrile condition, and only after four or five days will this slight reaction permit us to relax the severity of regimen. Most frequently the functions are not re-established so promptly or completely. Inflammation of the peritoneum may extend instead of abating, or the course of fecal matters may not be easily re-established. The superior portion of the intestine may have been filled with substances more or less solid, which keep it distended in comparison with that which has been constricted. The peristaltic motion having besides been disturbed, sometimes resumes with difficulty its habitual rhythm, and the fecal matters are therefore not pushed downwards with sufficient force to arrive without obstacle at the inferior extremity of the alimentary canal. This sluggishness of the intestine may depend on the moderate inflammation of its several tunics which may have occurred in the vicinity of the hernia. If therefore the stools are not spontaneously re-established in two or three hours, a mild injection is to be given. If this be not sufficient, another of more stimulating effects is to be administered. If after twelve hours evacuations have not been produced, purgative enemata with the decoction of senna must be resorted to. Many practitioners are in the habit of employing at the same time a slight purgative administered by the mouth. Dionis, who insists much on the advantage of this mode, says he received it from Moreau physician to the Dauphiness. Some surgeons, at the head of whom must be placed Dupuytren and Mr. Green, nevertheless condemn its use, by saying that it can only increase or aggravate an inflammation already giving too much cause for apprehension in individuals affected with strangulated hernia. At first view this reasoning may deceive, although in fact it is easy of refutation. The truth is, that the matters accumulated in the intestine are a powerful cause of inflammation; and the best mode of overcoming or preventing this inflammation is to oblige them to escape by the rectum. In this light, purgative enemata and potions of the same nature have an efficacy which cannot be doubted, At the hospital of Tours, I have seen M. Gouraud operate for a great number of hernias; to all his patients a purgative clyster was administered almost immediately after, and no where to my knowledge has a greater proportion of success been

obtained. M. Boyer, who seems to follow the same practice, has the reputation of being very fortunate in this kind of operation. As to the nature of the purgative it may be varied. Some give one or two ounces of castor oil in spoonful doses; others the epsom salts. The dose that I prefer, because I have seen it employed with great benefit, is composed of an ounce or two of manna dissolved in a glassful of mint infusion. Some prefer this last article in four ounces of red wine. Common opinion is against the use of this vehicle, and for myself I have nothing to say in its favor. It is unnecessary to add that the administration of a purgative is not called for, and is at least useless when the stools occur spontaneously and no sign of intestinal embarrassment is manifest.

When instead of simple obstruction symptoms of true inflammation are remarked, or when peritonitis is threatened, notwithstanding the course of the feces is re-established, the patient should without hesitation be subjected to the most energetic antiphlogistic treatment. One or more bleedings from the arm, one or more applications of leeches to the number of twenty, thirty, forty, and even sixty, if the strength of the patient permit, in the course of twenty-four hours, should be prescribed, if instead of decreasing the phlegmasia tends on the contrary to extend and become general. I see no reason why the mercurial treatment, *mercurialization*, should not have its turn; why we should not make every two or three hours friction on the abdomen with two or three drams of Neapolitan ointment, giving at the same time two grains of calomel every two hours. The cases of puerperal, simple, and traumatic peritonitis, which have evidently yielded to this treatment, sufficiently authorize its use whenever sanguineous evacuations give no further chance of success. Unfortunately these are not the only obstacles which may oppose the re-establishment of the functions after celotomy. Besides the return *en masse* of the intestine which continues to be strangulated by the neck of the sac, or which lodges in the substance of the abdominal parietes, it is also to be feared, lest the loop which was without, pass in its return above or below an abnormal band which is so often met with behind or around the herniary openings; and of which almost every author reports examples. It is also possible, that the portion just reduced may make a bend or angle so acute as not to allow the matters to pass through it, of which a case of Lassus gives instance. The same difficulty may depend on the intestine being twisted so as entirely to close its cavity. It may, moreover, have passed through a rent in the epiploon, in some old false membrane or in the mesentery. In fine, if the vomiting, pain, and distress continue with the constipation after the reduction of the viscera, without these symptoms being referable to violent inflammation of the peritoneum or some viscus, when there is no reason to suspect an effusion of intestinal matter we are authorized to conclude that the strangulation still exists, and from external has become internal. In this case the patient runs the greatest risk, for with the exception of very few cases surgery has but feeble aid to offer. However, we should try those that reason recommends. The first indication is to bring out the hernia, as when the viscera have been returned, pushing before them the neck of the sac. The patient is for this purpose made to cough and move about; if unsuccessful, the finger should be carried through the ring into the abdomen to discover as much as possible the state of things. If the surgeon clearly distinguishes the intestinal loop, and finds it tense, fixed,

immovable, he will attempt to seize it with dressing forceps and bring it without. If a band, a circle or any lamella seem to cause the stricture, he should immediately divide it with scissors or the bistoury, directed by the finger. If the finger cannot reach the parts, or only affords confused notions of their disposition, the environs of the wound are to be examined with care, to see if the organs contained in the abdomen form there no prominence or tumor visible through the skin. There is no question that then in a desperate case he should freely enlarge the incision of the ring, and penetrate as far as the point occupied by the strangulated organs; so as to bring them completely in view, and be enabled to give them full liberty to spread within the abdomen.

§ 5. *Gastrotomy.*

The symptoms which characterize internal strangulation being due to the inability of the intestinal matters to pass through their natural course, should be altogether similar to those of incarcerated hernia. It seems then at first view that this is easily recognized. We have on the one hand all the signs of herniary strangulation, and on the other a complete absence of swelling on the surface of the body; yet it some times happens that the diagnosis remains uncertain. Notwithstanding the presence of an external hernia, it is not impossible to mistake for external strangulation a disease entirely independent of it. A partial peritonitis, an acute inflammatory tumor of the bottom of the abdomen, and abscesses which are frequently developed in either iliac fossa, have often been the cause of repeated vomitings, obstinate constipation, and acute pain, upon a fixed and circumscribed point of the peritoneal cavity. In fine, an almost insurmountable difficulty consists in distinguishing the obstacle in question from organic lesion of the intestine, from volvulus, and from strangulation proper. However, if the affection attacks suddenly upon a strain or any violence whatever, if the patient has thought he perceived a tearing accompanied with crepitation and pain, propagated from a given point to the rest of the abdomen, if from this moment vomiting first of alimentary and mucous substances, and then of stercoraceous matters continues, while alvine evacuations have become impossible, and the usual signs of violent peritonitis are absent, it would be very difficult not to admit the existence of internal strangulation. Three different methods have been proposed to remedy accidents of this description. The old surgeons who were famous for suspecting invaginations and twisting of the alimentary tube, had great confidence in quicksilver, leaden bullets, purgatives, &c. They hoped by means of such heavy or active substances to act mechanically upon the entrails, or force them to become disengaged by means of precipitate movements. MM. Balluci, Bellini, and Ribell have in our days brought out examples in favor of fluid mercury. In recent and simple volvulus such resources may be followed sometimes with success; but there is no one who would not be deterred from their use in cases of internal strangulation. For my part I would not hazard the attempt. Local and general bleeding, cataplasms, opiates, calculated to moderate inflammation and ease pains, have no kind of influence over the state of stricture in which the intestine is found. Their sole advantage lies in favoring the efforts of the system and the action, by means of which it has been in certain cases so fortunate as to re-establish the continuity of the intestine without effacing its calibre. The ivaginated intestinal portion, may in fact after a

shorter or longer period and alarming symptoms, separate by the rupture of its neck, or of its root, whether from gangrene or the progress of simple, eliminative ulceration. Then the mortified mass becoming free passes through all the inferior portion of the alimentary tube, and is in the end expelled. In this manner have come away the cœcum, a great portion of the sigmoid flexure of the colon, and a considerable portion of small intestine, of which the memoir of Hevin contains numerous examples. MM. Rigal and Bourial have seen as much as thirty inches of the small intestine expelled by this mechanism. Similar observations have been reported by MM. Mallet of Rouen, Baille, Lobstein, Lacoste, Boucher of Lille, Gualthier of Claubry, &c. Other facts no less remarkable have been since collected and published in the Bulletins of the Philomathic Society, and the society of the Faculty of Medicine, in many theses, and most of the scientific journals.

It is easy to see that such a termination is not possible except in cases of invagination, and that to destroy a real strangulation we cannot depend upon the efforts of the system. Gastrotomy presents as the last resort. Up to the present time but few persons have dared to perform it, and experience has in some degree remained silent as to its value. We cannot, indeed, take any count of the history of the Baroness of Lanti, mentioned by Bonnet, who according to an ecclesiastic had been cured of an iliac passion by incision of the lower belly. Although the case in which Nuck advised the abdomen to be opened, in order to reach the intestines and set them free, is a little more authentic, and although M. Fusch has shown latterally a case of gastrotomy for invagination completely successful, we can yet rely only with extreme reserve on this paucity of observations. However, if it happen that we have a certainty almost complete of the existence either of a recent invagination or of a strangulation, and that the location of the disease is well determined, we ought, I think, to hazard the operation of gastrotomy, which was employed in the time of Praxagoras who performed it, uniting the wound of the abdomen immediately by the suture. M. Dupuytren, who tried it once, would probably have succeeded if he could have cut as he wished on the side where the pain was felt, instead of the linea alba according to the advice of the consulting surgeons. One case at the hospital St. Antoine, proves also that it is sometimes possible to tell exactly enough during life the precise seat of the strangulation, and that Laennec was probably right in advising the epigastrium to be opened in diaphragmatic hernias in order to remove the viscera from the chest with the fingers. The patient should be placed as for the operation of ordinary hernia. The incision, better crescentic than straight, should be made very near the strangulation. If we are not sure of the seat of this last, it is to be made outside of the rectus muscle, and with the fingers we are then to seek for the diseased portion. In a case of invagination the two ends of the intestine are to be drawn in an opposite direction, and the whole immediately replaced in the peritoneal cavity. If there is strangulation the finger will doubtless detect it and insulate it, so that a curved bistoury wrapped with linen to within several lines of its extremity, may divide without danger the band or constricting circle. Another species of internal strangulation deserves to be noticed; it is that which occurs after the forced reduction of a hernia. When it is caused by the neck of the sac, if the taxis is employed with any violence the tumor may return dragging with it its intimate covering. Then it places itself between the parietal peritoneum and the deep aponeurosis of

the abdomen, precisely as it is observed in some cases of the operation for strangulated hernia, properly so called. M. Delmas cites a case in which the organs were thus arrested in the very substance of the muscles. They may also pass beneath a band, or through a fissure in the same manner as in reducing them after opening the sac, as I have already mentioned. It is unfortunately too common a thing to see these reductions *en masse* under the influence of the taxis, offer no impediment to the progress of the symptoms. There are few authors who have not collected examples, and they are still daily met with in practice. If the symptoms only announce the continuation of the strangulation, without indicating the existence of fecal effusion; in other words, if the intestine seem neither gangrenous nor broken, we should not despair of the life of the patient, but attempt to give him assistance. The first care is to bring out the hernia again. If nothing present at the ring, the surgeon would be blameable to temporize too long, and refrain from performing the operation immediately. He knows that a herniary tumor exists, that after giving rise to symptoms or remaining for some time without, it has disappeared suddenly under the influence of external efforts; the opening which gave it passage is free and easily admits the extremity of the finger, quite frequently even presents a kind of depression or cul-de-sac, seems to be drawn inwards by some band or adherent membrane; sometimes also the finger introduced into this depression feels at its bottom the intestinal tumor incompletely reduced. In this supposition the soft parts are to be incised as in ordinary strangulated hernia, and by degrees we arrive at its interior. If the sac can be reached, it is rare that the operator does not reach the seat of the disorder. M. Dupuytren, who has been frequently called upon in this species of strangulation, and, at the Hotel Dieu, has seen a great number of cases, remarks, that after having vainly endeavored to bring out the viscera again, there remains the resource of freely incising the ring in the direction in which there are no vessels, and of arriving thus within the abdomen.

§ 6. *Hernia with Gangrene.*

Gangrene.—When gangrene is evident the division of the tissues does not require the same precautions as in the ordinary operation. The incisions in fact may without danger penetrate at one stroke as far as the intestine. If it affect all the tumor, and the hernia is voluminous, after several deep incisions the whole of the mortified parts should be removed; we may however confine the incision to the intestinal loop and wait for the exfoliation of the remaining tissues. Numerous cases attest that the system may then quite easily effect a complete case. Traveling in Germany, J. L. Petit alighted one day at a tavern, and was immediately struck with the odor of gangrene. He was shown in the adjoining room a man laboring under the symptoms of hernia with mortification. Thinking this man lost, he merely made some incisions in the tumor, which immediately discharged an abundant quantity of matters. On his return, twenty-eight days afterwards, he learned, not without surprise, that his patient was completely cured, and that without *stercoral fistula.* Going, on another occasion, to La Ferte-sous-Jouarre, and losing his way in the night, he stopped at a house in which he saw a light to inquire the road. The woman of the house told him that her husband was at the point of death

and entreated him to enter. This was also a case of strangulated hernia, which J. L. Petit contended himself with opening and cleansing, recommending them to use no other treatment, thinking that the patient could not recover. A cure took place however, and the individual himself went sometime after to inform the surgeon of it. But it cannot be denied, that it is better to free the tumor with the scissors or bistoury of all its contents which are evidently mortified. For the rest, there is no reason to act otherwise than if the intestine alone were mortified, and the gangrene only known after opening the sac. In this last case the gangrene may occupy only the most projecting part of the strangulated loop, as it may have its seat even within the ring, and on the points which immediately suffer the constriction. Several methods have been advised in this case. One of the most ancient consists in opening the intestine freely to give issue to the contained matters, and trusting for the rest to the resources of nature. By acting in this way two things are to be apprehended; first, that the stricture may be such as to render difficult the passage of the substances which should pass through the alimentary canal; and secondly, the almost necessary establishment of a preternatural anus. To these apprehensions some reply that the ring is always large enough to permit the end of the intestine in its natural state to preserve within it its permeability; that the inferior portion of this canal, receiving no more matters, becomes obliterated; that the portion corresponding with the stomach alone continuing to receive the alimentary mass, must be sufficiently free in the herniary orifice, to fullfil without danger the functions of an abnormal anus. On the other hand, experience shows that this practice has often been followed by a radical and ready cure. The two cases just quoted are a proof of this, and J. L. Petit relates others no less remarkable. Thus, being in Flanders, this surgeon was called, on his way to Douay, to give his advice respecting a tumor, which was strangulated and could not be reduced A charlatan, whose advice the patient and his friends adopted, maintained that this tumor was an abscess and ought to be opened. J. L. Petit declared that serious accident might be the result, and that at least a stercoral fistula would follow. On his return they assured him that the patient was perfectly cured. He learned moreover that this man thus opened all strangulated hernias, and in the environs of Douay and Cambray he had in this manner operated on a great number of persons, which practice had given him a brilliant reputation in the country. I saw last year a student of medicine who assured me that his father, a provincial surgeon, had been induced from experience to pursue a similar method, and that ten or twelve times already he had used it with success, whether the strangulated hernia was or was not attended with gangrene. When it is remembered that preternatural ani of long standing have in the end spontaneously disappeared, although the two ends of the intestine had become fixed and stopped in the ring, and a considerable portion had been removed, these results soon lose their marvellous aspect. In fact, the intestine being opened and ceasing to be distended in hernia is a reason also for the speedy disappearance of the strangulation. The elasticity of the mesentery and the natural movements of the organs contained in the abdomen, must tend without interruption to draw towards their roots that which had escaped in hernia. By degrees the two ends of intestine gain the posterior face of the ring, and approach each other; their orifices finally correspond;

substances pass from the superior to the inferior portion, instead of escaping by the wound, which also, by its retraction opposes a greater or less resistance. All authors however do not view this in the same light. Scarpa directs, after opening the intestine that the ring be incised more or less. Without this precaution, says he, matters accumulated behind would have too much difficulty in escaping, and might create a dangerous inflammation, supposing even that they do not keep up the symptoms of strangulation. What danger after all would there be in this practice? The adhesions which he admits on the limits of the gangrene would be full assurance of safety. Even when the intestine would have to be incised from within outwards at the same time as the sac or the fibrous ring that surrounds it, according to his views there would be no reason to fear effusion into the peritoneum. Of late, M. Dupuytren, who strenuously opposes this doctrine, maintains that when there is gangrene extending to the ring the edges of the herniary orifice are usually mortified, and that the intestine being opened the strangulation must soon disappear of itself, and consequently render no kind of incision necessary. He thinks besides that the adhesions pointed out by Scarpa are far from being constant on the whole circumference of the intestine, and that they would not oppose a sufficient barrier to the effusion of matters if the incision of the digestive tube was carried behind the ring.

It is certainly incorrect to say that gangrene is never developed without being preceded by adhesions between the neighboring serous surfaces. Several times already has the opening of bodies who died from strangulated hernia, convinced me that Scarpa has singularly exaggerated the importance of this morbid condition, and that he was led into error as to the frequency and rapidity of its development; that in fine these adhesions are sometimes confined within such narrow limits that it would be difficult not to go beyond them in giving freedom to the herniary circle through the intestine. On the other hand it seems to me that mortification of the neck of the sac, and of the edges of the ring, is much less common than M. Corbin and Caillard, make M. Dupuytren to affirm, and that if we were to rely on it to terminate the strangulation we would frequently have to repent our confidence. It does not take place, for instance, when the mortification is in the free part of the intestine. As the intestine is endowed with a vitality much more active, and contains vessels in much greater number than the opening which compresses it, it were to be presumed, if experience did not prove it, that in becoming gangrenous in the ring it would not necessarily induce mortification of the latter. I will add, that if we do not incise it, the intestine more or less inflamed behind the destroyed part becomes generally the seat of considerable swelling which invades its three tunics and principally its mucous coat, and that this swelling arrested behind by the constricting circle is developed almost entirely on the internal side, so as sometimes to produce a more or less complete obliteration of the intestinal opening. I saw this in a woman treated for hernia with gangrene at the hospital of Improvement, in 1824, and who died the next day. It has also happened several times in other hospitals at Paris within several years, if I may believe the report of several residents sufficiently instructed to form a correct judgment on such questions. In short, if after having opened the intestine the matters it contains, whether in the hernia or within the abdomen, freely escape by the opening, if the stricture

of the ring is slight, incision is to be dispensed with. If on the contrary the finger carried into the strangulated portion have difficulty in penetrating and passing, prudence dictates in my opinion that this opening should be enlarged. If the instrument can be easily passed between the viscus and the sac, without exposing to destruction the adhesions which may exist behind, the incisions may be performed as in the ordinary operation. If it be otherwise, the bistoury is to be carried into the interior of the intestine, to cut from the centre to the circumference in one or several directions the orifice through which the matters are to pass. By reflecting on the natural disposition of the parts, it will be seen moreover that these incisions expose less than is thought to an effusion into the peritoneum. This effusion cannot in fact be feared, unless the incision is carried beyond the posterior orifice of the ring, and consequently much beyond the place occupied by the strangulation; the stricture in these cases being almost constantly a little nearer the external aponeurosis than the *fascia propria* or the interior peritoneum. This perhaps may reconcile the ideas of M. Dupuytren with the practice of Scarpa. Yet I cannot omit saying, that the danger of not incising in case of gangrene does not at first appear very great. If after some hours the colic continues, the symptoms of strangulation have not ceased, and in removing the dressing we see that the matters escape with difficulty, we are then able to introduce into the superior part of the intestine either a female catheter, a silver canula, or still better a large tube of gumelastic, and thus remedy this difficulty at once. If notwithstanding this attention the engorgement of the tissues and the narrowness of the ring oppose the re-establishment of the functions, it will be still time on the next day or the day following to dilate by incision, as would have been done on the day of the operation, and perhaps with less apprehension, since it is then almost impossible that solid adhesions should not have been effected around the herniary opening.

§ 7. *Enteroraphy.*

We have as yet supposed the parts left in place, but a great number of practitioners think it necessary, in order to be assured of the limits of the gangrene, to draw through the ring a portion of the intestine which has not been contained in it; to excise by cutting upon the living portion all that is mortified; to reduce the sound parts so as to leave in the wound only the opening or openings that have just been made, or to attempt on the spot their immediate union by stretching together the two ends of intestine; hence have arisen several important operations.

1st. *Littre* for example tied the inferior end so as to produce its obliteration, and kept the superior end in the ring, establishing an artificial anus which the patient was to carry during the remainder of his life. Louis, who was not opposed to the practice of Littre, found however one difficulty, that of distinguishing immediately the superior from the inferior portion of the alimentary tube. To obviate this, he advised to give the patient a little syrup of cichory, which being evacuated after some hours would indicate by its green color in which direction was the stomach and in which the rectum. This would be an ingenious mode without doubt, but it is rare that we are obliged to have recourse to it. After the division of the intestine, its inferior end

rarely fails of collapsing and dwindling to the size of a large cord, while the other preserves nearly its primitive dimensions, and besides does not cease to give issue to fecal matters. The process of Littre, having for its end the establishment of a disgusting infirmity ought to be rejected, and deserves not the least attention at the present day.

2d. *Lapeyronie* has proposed another, at the same time more simple and much more rational. The surgeon passes behind the division a double thread through a fold of the mesentery, and after pushing the two ends of the intestine within the abnormal limits, uses this thread to prevent its being lost completely by fastening them externally to any part of the dressings. An artificial anus is thus obtained it is true, but one that can be cured spontaneously or by the assistance of art. Scarpa, who condemns this process of Lapeyronie, directs after destroying the gangrenous parts to leave the two ends of the organ in the wound. The adhesions which they have contracted, says he, while the mortification was in progress, always suffice to prevent their too rapid return and all danger of effusion into the peritoneum. According to him the mesenteric thread would be injurious in more than one respect; first, in being an obstacle to the gradual retraction of the parts, and to the formation of what the celebrated surgeon of Pavia calls the *membranous funnel* of the artificial anus; secondly because the thread, which will shortly cut through the mesentery, may at the same time divide vessels from which hemorrhage might be serious; and in the last place, because, resting against the deeper face of the intestines it is capable of causing ulceration and perforation, in the same manner as a ligature cuts through an artery around which it has been placed. But as the fears of Scarpa are not entertained by all surgeons, some have put in practice the process of Lapeyronie even of late, and say they have no reason to regret it. M. Hervez of Chegoin, among others, reported a case to the academy of medicine, in 1829. It would be easy, besides, to leave this thread in place for only one or two days if its presence proved really obnoxious. Instead of forming a noose of it the two portions of which should be united or twisted on each other, they may be kept apart by fastening them separately without, and after a given time it would be very easy to withdraw this thread by pulling one of its extremities before it could divide the mesentery or destroy the continuity of the intestine. No doubt we may in strictness dispense with the precaution of Lapeyronie when the excision has not been made in the living part, or when it is very near the ring, and if during the operation we have not thought proper to displace the strangulated intestinal circle; but in other cases it would be imprudent I think to leave hanging in the wound, as Richter directs, a long portion of the divided organ, or to push it back into the strangulating circle, as proposed by Desault, without taking the precaution of fastening it by some means to the exterior.

3d. *Suture.*—By following the course just marked out, the immediate result will be a stercoral fistula, or a preternatural anus. The suture has been proposed for the purpose of preventing this infirmity by immediately re-establishing the continuity of the divided tube. This indication many authors have endeavored to fulfill by various means, which having often sunk into neglect has of late been again attracting some attention.

Upon a Foreign Body.—To four gentlemen who united for the purpose of relieving in common the poor patients of Paris, is attributed the first idea

of bringing together the two ends of the intestine and sewing them. These surgeons commenced, it is said, by procuring the trachea of an animal, and introduced one of its extremities into the superior, and the other into the inferior division of the interrupted canal, the two raw circles of which were then approximated, and fastened and kept in contact by several stitches which also passed through the trachea, and after some time were with it carried off in the stools. G. de Salicet, who lived before Guy de Chauliac, does not mention the trachea of the animal, but he was acquainted with the process of the four surgeons and formally condemns it. "Do not listen," says he, "to those who say that before sewing the gut, an 'elder pipe or some such thing should be put in, and that upon this canula the wounded gut is to be sewed, for,' &c. and further 'it would be better———a portion of the gut of some beast——— but neither this nor any thing else———.'" For the rest, it is very certain that the old surgeons had on this subject the idea which is at present entertained. Guillaume only mentions it in incomplete divisions of the intestinal circle, and expressly informs us that all others are necessarily fatal. Nothing shows that Guy entertained a different opinion, "And if there is necessity for sewing (the parts cantained in the abdomen), and that it be of benefit as at the bottom of the stomach and large guts, let them be sewed with the glover's stitch. Some, as Garnier, Rogier, and Theodore, put into the gut a canula of elder to prevent the feces from rotting the stitches. Others, as Guillaume has related, place in it the portion of the gut of some beast, or a portion of the trachea arteria as the four masters direct." Watson has since proposed a canula of isinglass. Some, with Scarpa, mention a cylinder of tallow. Sabatier, Ritch, Desault, and Chopart, direct a piece of a playing card smeared with essence of turpentine or the oil of hypericum, or varnished in any other manner. The process of the ancients had so little attracted attention, that Duverger a surgeon of Maubeuge, who reproduced it at the beginning of the last century, was thought to be its inventor. It does not appear after all that it has been often tried, or that up to the present time there have been more than two or three successful cases. If it is to be attempted, it would be in my opinion a matter of indifference whether to employ a very pliant animal trachea, a cylinder of fish-glue, of card or paper, or a canula of gumelastic. Having coated with varnish this species of tunnel or tube, which must of necessity be somewhat smaller than the intestine, three or four loops of thread or silk are to be passed through the middle several lines distant from each other, each carrying a needle at its extremity to make so many stitches. Its introduction into the superior division of the alimentary tube will be attended but with very trifling difficulty; but for its admission into the lower portion, that part should be held by two pairs of forceps, keeping its sides apart and thus enlarging the opening. This being done, the ends of each thread ought to be passed successively from within outwards, at two or three lines from the edge, through the corresponding end of intestine. After they have been tied and cut very near the knot, the whole is replaced in the abdomen; a gentle purgative is then given, and the patient treated as after the ordinary operation for strangulated hernia. While the union is taking place, the threads are cutting through the tissues, and when this is accomplished the foreign body being set free descends with the intestinal matters and is expelled. Instead of four threads, Durverger recommends but two, one in front, the other behind. Those of Ritch, depend-

ing on the same cord, had the inconvenience of forming a kind of transverse bridge in the interior of the card. Desault had no other motive than to remove this peculiarity, in proposing the modification attributed to him, which is not of sufficient importance to be given here in detail. This suture is in the first place difficult to perform; and besides, it is to be feared that in the space between the stitches union may not take place, and that becoming free the threads may leave ulcerations, and allow fluids to be effused. In fine, its dangers are so formidable, that in the absence of conclusive experiments and numerous facts which science does not yet possess, despair of every other means should alone induce us to determine upon its employment.

4th. *Suture with Invagination.*—Randhor, a surgeon of the duke of Brunswick, having to treat a soldier in whom the continuity of the intestinal tube had just been destroyed, concluded to introduce the superior into the inferior portion, and fix it in this position by two stitches, reduce it, and leave it then in the abdomen. His patient was completely cured. He died several years after of another affection, and Randhor was enabled to examine the state of the parts. He removed the portion formerly divided and sent it to Mœbius, who had occasion to show it to Heister, who immediately began to try the same operation on dogs but without success. Extolled by some, rejected as impossible or dangerous by others, admitted by Louis to be very ingenious, and tried a number of times since it became known, the method of Randhor seems to have succeeded but in a very small number of cases. M. Boyer performed it once; his patient died. In another case he could not finish it. I have seen it tried by M. Richerand at the hospital St. Louis on a patient who also died the next day. M. Lavielle of Membaste, MM. Chemery Have, Schmidt, and some others, have however each reported a case of success in support of the Ranhorian operation.

The first difficulty is to overcome the contraction of the inferior division of the intestine. One of the best means for this purpose, is to seize by their four extremities at once the two principal diameters with as many forceps or hooks. To prevent the superior division from filling or swelling an assistant has to take hold of four or five inches of it and keep it sufficiently compressed, while the surgeon endeavors to fix it in the orifice of the rectal portion. But there is another obstacle, which M. Richerand I believe was the first clearly and positively to point out. The researches of Bichat on the different tissues, prove in fact that mucous membranes will contract no mutual adhesions; and that adhesive inflammation in general only takes place between cellular surfaces. But in the invagination after the manner of Randhor, it is the peritoneal coat of the superior intestinal portion which is in contact with the mucous membrane of the other. If the law established by Bichat is correct, and if the remark of M. Richerand is well founded, adhesion of the two ends of the intestine must be impossible by the method. Thus was it nearly renounced, when M. Raybard advocated it anew, and endeavored to show that it ought to be preferred to that which has recently been brought forward to supply its place.

Process of M. Raybard.—In support of his assertions this surgeon publishes a certain number of experiments upon living animals, and observations in pathological anatomy gathered from man. Like Randhor, M. Raybard directs the mesentery first to be incised parallel with the concavity of the intestine,

to the extent of several lines. He then passes a thread a little above the wound, so that one of its ends remains within the canal while the other hangs without. According to him, it is sufficient to have two loops thus placed, one upon each extremity of the antero-posterior diameter of the altered canal. With a needle, the internal extremity of each is passed from within outwards through the inferior division of the organ, to invaginate methodically the two parts, and terminate by tying each stitch into a knot. M. Raybard contends that his process is at once the most certain and easy, and much less dangerous than that proposed by M. Jobert; I have not learned that he has made any application of it to the human subject.

Suture with Contact of Serous Surfaces.—Experiments, already of ancient date, may be brought to the support of M. Richerand's ideas. Messrs. Schmidt, Thompson, and Travers have noticed this singular phenomenon, viz. that if a thread is tied round a small perforation of the intestine, this thread soon buries itself as in a depression, so as to approach gradually the interior of the canal and there become entirely free, at the same time that the membrane or the serous surface approximates behind, and blends with a plastic layer, so as to prevent the opening which would otherwise be the consequence. Besides, Mr. Travers has seen that if the whole calibre of the alimentary canal is strangulated, the peritoneum of the superior portion adheres so rapidly to that of the inferior part, that the septum formed by this strangulation soon becomes gangrenous, is detached, and carried in the direction of the rectum, so that at length the tube is completely re-established. In France the labors of M. Dupuytren on preternatural anus give the same fact, and show with what facility and promptitude two points of the external face of the intestine unite when kept in contact.

Process of M. Jobert.—From these various elements, M. Jobert has derived a method which seems at first to promise real advantage. This surgeon begins by turning inwards the orifice of the inferior intestinal division, he then performs the suture like Randhor, and in this manner contrives that the two ends of the organ shall be in contact by their serous surfaces. Two threads are sufficient, he does not tie them, but keeps them without so as to remove them after several days by drawing on their extremities. Experiments made upon cats and dogs have, it is said, perfectly succeeded in his hands. He has shown several to the *committee* of the academy of medicine, who have seen the digestive tube fully cicatrized, presenting a solid ring, projecting internally, and very complete at the place which had been occupied by the wound. But this kind of invagination does not seem to present less serious difficulties than that of Randhor, and at first view offers only the advantage of placing in contact two portions of peritoneum, instead of applying the peritoneum against a mucous membrane as in the ancient process. There are wanting examples of this mode of proceeding on the human subject.

Process of M. Denans.—A surgeon of Marseilles, M. Denans, proposed about the same period with M. Jobert another sort of invagination. Three small hollow cylinders of metal are necessary for it. He places one in each end of the intestine, the wound of which he inverts or invaginates on the internal face of this species of rings; the third, a little smaller than the other two, is to be passed within the upper one and then within the inferior, so as to form a kind of staff or axis for the support of both. A thread embraces and

fixes all three upon two different points of the intestinal circle. The ends of the suture are cut very near the peritoneum, and the whole is replaced and left in the abdomen. Union of the parts soon takes place. All that is pressed between the three cylinders soon becomes gangrenous, is detached, and these foreign bodies descend and are discharged by stool. At the last meeting for admission M. Guersent, Jr. justified all the assertions of M. Denans by showing to the jury a portion of intestine perfectly cicatrized, the two ends of which had been coaptated by the process of the cylinders.

Process of M. Lembert.—M. Lembert, a former student in the hospitals of Paris, proposed, in 1825, another method of bringing the serous surfaces together. With an ordinary needle he passed as many threads as he wished to make stitches through the parietes of the superior portion first, and then through those of the inferior end of the intestine. The point of his needle is carried two or three lines from the wound on the external surface of the organ; he makes it penetrate as far as the mucous membrane, passing between the tissues, brings it out at about two lines from its insertion, and thus fixes his thread; with the same precautions he directs the needle on the external face and in the substance of the rectal end of the intestine, applying successively and in the same manner all the threads he deems proper, and has then only to tie them to complete the suture. By drawing upon these threads the lips of the wound are forced to be inverted on their internal surface, forming a valve or border projecting into the interior of the canal, producing at the same time the immediate contact of the external surface of the ends of intestine whose continuity is to be re-established. These three processes tend to the same end, the union of two serous surfaces. That of M. Denans seems to offer more certainty and less danger than the two others, inasmuch as nothing can derange it. However, who would be so bold as thus to leave the intestine in the abdomen? Who can insure that these inflexible cylinders will not perforate the organ if they should take a wrong position in the interior of the abdomen? In operating like M. Jobert there is danger of the threads relaxing, and some points of the intestinal periphery may remain disunited and permit effusion. The modification of M. Lembert is apparently much more simple and easy, it requires no previous inversion nor invagination, but it seems to be more likely than the preceding to leave some vacancy between the stitches, through which substances of some fluidity may escape. If I intended to employ it I would prefer using the overcast stitch; that is, I would pass the needle obliquely from above downwards, from the superior end over the external face of the inferior, so as to reascend to the first a line or two from the point of departure, returning upon the second, and then again to the first, and so on until I had gone over the whole circumference of the intestine. To finish I should only have to draw in different directions the two ends of the thread, of which one would be the beginning and the other the termination of the suture. If simple pulling will not force the lips of the wound to become inverted, and the peritoneal coats to come into mutual contact, the beak of a sound will complete the suture with great facility. A double knot will then finish the operation. The extremities of the thread or one of them will be sufficient to retain the organ behind the ring, if we do not wish to leave it at large in the abdomen, in which case a knot is not indispensable. But after all, does prudence permit us to have recourse to such means, means

which will necessarily produce death if they should fail of their intended effect? Is it right thus to risk human life, when by establishing an artificial anus we are almost sure of an eventual cure? I have practised upon dogs the process of M. Jobert and that of M. Lembert modified as I have just shown. Whether it was that I did not take all proper precautions, or that I had not the skill necessary for the attempt, I must confess, that in two cases out of six fecal matters were effused into the abdomen, and the death of the animals was the consequence. I will add, that of the other four only two were perfectly cured, while the third and fourth retained a small orifice through which escaped mucosities, and which were not surrounded with adhesions or false membranes and gave no favorable assurances for the future. I also wished to renew the experiments of Mr. Travers, and the truth is, that in the two dogs, all that I tried, the strangulated intestine broke, and I found it wholly divided after the death of the animals, which took place on the following day.

B. *Ulceration.*—What I have as yet said is only applicable to wounds which include the whole of the intestinal circumference, either with or without loss of substance, whether dependant on gangrene or a wound on some point of the abdominal cavity. If the mortification is confined to the peritoneal coat, or does not extend to the mucous membrane, we may, as Desault recommends, restore their parts to the place, and trust entirely to the resources of nature. Adhesive inflammation will be developed around the altered layer, and soon produce exfoliation of the dead lamellæ, and will not permit the intestine to be perforated. But one of two things is true: either the gangrene is evident, and in this case not having any certainty whether it extends or does not extend through the substance of the organic parietes, the surgeon cannot think of reduction; or, its existence may be doubtful, and then prudence directs that the intestine be returned into the abdomen. If it occupies but a small space, the part may be cut out, including some of the living portion, and so as to form an elliptical wound, longitudinally or transversely as it may be easiest to make it in one or the other of these directions. On the contrary, if it occupies a great part of the circumference of the intestine, and that for more than half an inch, it would be better to remove a complete segment of this cylinder, and to try one of the methods pointed out above. The gangrenous portions being removed, the solution of continuity is reduced to the state of a simple wound, and is to be treated as such. Modern experience has proved that the perforation of an intestine by a penetrating or cutting instrument may be left without danger in the abdomen when it is less than two or three lines in diameter. The muscular fibres soon contract its circumference, so as to force the mucous membrane to become engaged in and close it. A larger incision, one of three or four lines for instance, does not more constantly cause extravasation; its edges adhere sometimes to the corresponding surface of another intestinal circumvolution, or it comes in contact with a fold of epiploon, which often engages in it and closes it like a stopper. It would be imprudent, however, when such lesions are visible to leave them to the care of nature. If it is true that the greater number of them are healed without giving rise to unpleasant symptoms, it is also very probable that some would be followed by fatal effusion. In hernias these wounds present under two distinct forms, first, in the state of a simple division when they are produced by the cutting instru-

ment used by the operator; secondly, under the aspect of ulcer or solution, with loss of substance if stricture in the ring has been the cause. In this last case there is scarcely any hope of seeing them closed without assistance, and if they are to be treated by the suture it is proper first to smooth their edges. We have here to choose among the glover's suture, the suture of Le Dran, and the suture *a points passes*. The glover's suture has the advantage of being quickly and easily performed, and of exactly closing the wound, but it is very difficult to withdraw the thread when we think union is effected. Besides being less quickly performed, the suture *a anse*, or of Le Dran, has the inconvenience of puckering and contracting the intestine in consequence of the size of the wound; but the threads being passed but once through the tissues are easily drawn and removed through the opening in the abdominal parietes. The suture *a points passes* offers nearly the same advantages as the glover's suture, and if modified as directed by Bichat its removal is less liable to produce rupture of the adhesions and growing cicatrix than the simple overcast stitch. The spiroid suture, combined with the principles of M. Lembert, seems no less entitled to respect. Whether the wound be longitudinal or transverse the operation is always to be performed after the same rules.

When the coaptation is effected, we may act in two different ways; first we may tie the suture and cut it close to the intestine, then reduce this, and leave it free in the abdominal cavity; or secondly, we may keep the thread and fasten it externally in the dressing, to prevent the wounded organ from escaping to any distance, and to force it to contract adhesions behind the ring. If it were true, as it is asserted, that ligatures fixed in the substance of the coats of the intestine always fall into the interior of the canal, the first method should evidently be preferred, since the other would not fail to obstruct in some degree the passage of intestinal matters; but most surgeons of the present day have not as yet adopted this plan. The two cases of M. Cloguet and M. Liegard, who followed the process of M. Lembert, are in fact the only ones as yet to be brought in its support; and quite recently too, M. Hervez of Chegoin preferred passing a thread into the mesentery to retain the wounded organ to attempting the suture, although the wound was not more than two lines in diameter. M. Raybard maintains that the principal end of enteroraphy is to fix the two lips of the solution separately behind the opening in the abdominal parietes, so that after they have been united with the peritoneum the threads may be drawn, and the division of the abdomen and that of the intestine healed at the same time. If it be a long wound this practitioner conducts the operation in the following manner. A flat piece of white wood, small, thin, and oiled, from twelve to fifteen lines long, and from four to six broad, is carried into the intestine. A loop of thread attached to the middle of this slip of wood, armed at each end with a needle, is then passed from one side to the other, from the interior to the exterior, through the whole substance of the abdominal parietes, so that the small foreign lamella presses at once the two lips of the intestine against the two sides of the abdominal wound, which at the same time it keeps hermetically closed.

When the adhesion of these various parts seems sufficiently solid, M. Raybard withdraws his thread, the slip of wood comes away with the stools, when the cicatrization of the wound in the abdomen only remains to be at-

tended to if not already healed. If this process is blamed for intentionally producing adhesions which will necessarily prevent the intestine from resuming its primitive mobility, it is but just to acknowledge that in other sutures the same thing almost as certainly takes place, if not as completely, whenever the extremities of the thread are kept without. It is even true that it is not more thoroughly avoided by cutting the threads close to the intestine and leaving the organ behind the wound. Adhesive inflammation, which is indispensable to cicatrization, seldom fails of uniting the circumference of the visceral wound to the tissues which are in more or less immediate contact with it. Another objection better founded is the use of the slip of wood, which seems hardly applicable to any other than longitudinal divisions the consequences of penetrating wounds of the abdomen, and not to cases where the parts have escaped through a herniary opening. For the rest we may have to fear lest the extremities or edges of this foreign body perforate the parietes of the wounded intestine by ulceration or gangrene. It must be admitted, however, that in wounds of the convexity of an intestinal loop, this process seems worthy of trial; the better, as it permits at once the immediate union of the abdominal wound by the twisted or quilled suture, or the suture *a points passes;* if not by the same thread which passes through the intestine as directed by M. Raybard. To resume; therefore, whether the intestine be held or left at large it does not cicatrize without uniting in some measure with the surrounding parts, so that on this point every one may be free to act according to his own ideas. Therefore I cannot seriously blame M. Guillaume for having sewed the external wound with the glover's suture, for a patient whom he treated for a division of the intestine. To conclude, if the parietes of the organic cylinder were only divided or perforated to the extent of one or two lines, it would be better to take hold of the two lips at once with a forceps and close it by passing round it a thread, as in tying the extremity of an artery. Sir A. Cooper and another surgeon I think have each had a successful case by this method in the London hospitals.

§ 8. *Preternatural Anus.*

The operations by which art sometimes remedies the preternatural anus are rather few in number. For a long time none was even attempted, and it is only since the middle of the last century that operative surgery has positively undertaken the relief of this disgusting affection.

A. *Suture.*—One of the first processes that presented itself to the mind, was the suture. It seemed that by approximating the lips of the wound or the integuments previously pared, and keeping them in contact, we might succeed in forcing the matters to resume their natural course and enter the inferior portion of the intestine. Lecat is the first who expressed a desire to put this method into execution. He had admitted into his hospital a woman affected for several months with preternatural anus in 1739, and for the purpose just pointed out; but various circumstances independent of his will caused his project to fail. Lebrun was more fortunate; he put in practice the idea of Lecat. A crucial suture appeared to him sufficient in the patient he had to treat. He used only caustic for making rare the lips of the wound. For two days every thing presaged success. There were no bad symptoms, and cica-

trization was already far advanced, when on the third day it became necessary to remove the threads and give issue to the intestinal matters. Lebrun intended to recommence the operation afterwards, but the patient would not on any account consent. This attempt has been generally blamed, so that few surgeons have been bold enough to renew it. It was however renewed some years since by M. Judey for an accidental inguinal anus of four months' standing, the consequence of gangrene. The success was complete according to M. Richerand who communicated the fact to the academy of medicine. M. Blandin seems to have been less fortunate. He once attempted to close a preternatural anus by the suture, but the symptoms that soon manifested themselves, obliged him to re-open the wound. A modification of this process could not fail of being, and in fact was proposed about twelve years since. The integuments in general are so hardened and blended with the subjacent layers around the wound that it would be extremely difficult to approximate its lips or bring them in contact. M. Collier thought that a portion of skin detached from the neighboring part, turned over and fixed by stitches or pins in the anus according to the principles of rhinoplasm would obviate this inconvenience. A patient thus treated by him was completely cured, and this mode of operating has received the approbation of M. Dupuytren, in cases at least where there remains only a stercoral fistula after the re-establishment of the alvine evacuation by the natural anus. Perhaps there would be an advantage also in modifying this last idea by dissecting the skin which surrounds the abnormal anus to the extent of an inch or two, preserving on its internal face as much cellular tissue as possible, and then making raw the ulcerated edges to give them a form more elongated and regular, and then fixing them with one or more points of twisted suture. The approximation will then take place without the least difficulty or dragging of the parts. A moderate compression would be then indispensable as in the preceding process, in order to keep the deeper surface of the dissected flaps in contact with the parts from which they have been separated, and prevent the intestinal matters from being effused between them. On the whole, suture of the abnormal anus is bad and should be proscribed. It is proper only in certain cases to complete the cure which sometimes remains imperfect after other treatment, or when by any means the course of the stools is re-established, and when for several months the stercoral orifice has given issue only to mucosities, biliary matters, or other intestinal fluids, and when in spite of every care and the best devised dressings, this orifice still remains. The suture by the process of M. Collier, or by dissection of the circumference of the wound may, I think, find in this case its proper application, and conduce to success.

B. *Compression.*—Compression is a means which has more than once been employed with advantage, and is still frequently used. It is besides, often indispensable as a preparatory step or a supplementary one, to remove certain complications which render other processes altogether impracticable. Thus the intestine may be invaginated through the preternatural anus, protrude externally, and in the end form a tumor which has in some subjects been seen to acquire a size of six inches, a foot, and even more in length, taking a cylindrical form, from the extremity of which fecal matters are discharged. It is evident that such an invagination constitutes a serious malady; and as many surgeons have remarked, its root is subject to strangulation like every

other species of hernia. Patients have died in consequence of it, and I need not say that when this strangulation exists, we ought if reduction is impossible to lay open the ring and incise it from within outwards; in a word, remove the stricture as in ordinary hernia. Even in the absence of all stricture the intestinal cylinder with its mucous membrane turned outwards does not remain long in this position without undergoing alterations. Thus it is to be apprehended that the peritoneum of the invaginated portion will soon contract intimate adhesions with that of the ensheathing portion, and the other tunics thicken and become hard, so as to render the reduction difficult if not altogether impossible. To remedy accidents of this description when not beyond the resources of art, compression has been advised. Desault, Sabatier, and Noel of Rheims, have vouched for its efficacy. Since then it has become in some sort a vulgar remedy. If the tumor is long, it is enveloped with thin compresses, after being cleansed; then a bandage is applied rather narrow than too wide, and is arranged in the same manner as a roller upon a limb. At first the diminution of this mass being very rapid, the bandage ought to be frequently reapplied; afterwards it is to be renewed at longer intervals. If the serous surfaces of the organ do not oppose an invincible obstacle, its reduction will soon become practicable. For the rest, it is evident that after this reduction the preternatural anus will nevertheless continue to exist, and other means must be used to make it disappear. As the projection, the kind of buttress or prominent margin which separates the superior intestinal portion from the inferior, is the principal obstacle to the passage of substances from the former into the latter, it was natural to expect that by pushing back this projection the disease might be cured. Compression was therefore proposed. It was in the school of Desault that it found most partizans and received useful improvements. By means of tents, introduced first into the inferior end and then into the superior and fastened without by a thread passed around the middle, Desault was confident of freeing a passage to the matters, which would not be long in following. His tent being placed, he applied a pyramidal tampon to support its convexity and push it as much as possible into the abdomen. When these tents could be introduced of considerable size, and the stools had returned almost to their natural freedom, he only compressed the external opening to prevent all oozing by it. It cannot be denied that a treatment so well contrived has more than once been attended with success. However, the presence of a tent filling both portions of the intestine, and of a pyramid of charpie, or compresses hermetically closing the wound, is not borne without inconvenience by every patient. Some suffer from colics, and pains so acute as to oblige them to abandon it. Another means of obtaining the same result has sometimes been employed at the Hotel Dieu. It is a kind of crescent of ebony or ivory from six to eight lines long, with a handle from five to six inches in length, and furnished with a sponge or compress. Carried to the bottom of the accidental anus, it embraces in its concavity the intestinal prominence, which is pushed back by pressing upon the handle wrapped with linen, and which it is easy to fix by means of a truss or other appropriate bandage.

C. *Enterotomy or M. Dupuytren's method.*—Notwithstanding compression, the most methodical and best applied, the preternatural anus sometimes resists the efforts of the surgeon, and continues to the despair of the patient. The

efforts of Scarpa, in throwing light upon the mechanism of this affection, have shown that what this author calls *the promontory*, results from the conjunction of the two ends of the intestine which present behind the ring, in the manner of a double barreled gun. This being the case, it was natural to endeavor not only to push back this projection but even to destroy it. Schmakhalden seems to have had the first notion of this, and published it in 1798, in his inaugural dissertation. He directs a curved needle to be passed through the base of this prominence, and a strong ligature to be introduced in order to cut by degrees in the direction of its length upon tightening the thread, or acting as in fistula *ad anum* by apolinosis. According to J. S. Dorsey, his father in law, Dr. Physick, tried a similar operation in January 1809, and completely succeeded.

The proposition of the German surgeon had made no impression in his country, and that of the American author would probably have passed unnoticed, if about the same time, in 1813, M. Dupuytren had not undertaken on his part to introduce it in France, and especially if he had not arrived at a method much more certain and more efficacious. Like Dr. Physick, the surgeon of the Hotel Dieu confined himself in his first operations to the carrying of a thread through the projection, so well described by Scarpa, in order to cut it from behind forwards. The adhesions contracted by the peritoneal surfaces around the union were sufficient to prevent all effusion into the abdomen. The matters being no longer gathered about the ring, and finding a passage through the inferior portion, necessarily took the course towards the rectum. Although several attempts confirmed these anticipations, M. Dupuytren soon discovered that the needle might be carried beyond the protecting adhesions, and perforate a point of the alimentary tube which communicated with the cavity of the peritoneum. Alarmed at this danger he thought of *enterotomy*, and for fifteen years followed it with almost constant success. His pincers, the internal face of the beak of which is undulated so as to embrace the parts more exactly and prevent their sliding upon each other, is jointed like a forceps, and closed by a screw through their handles. One of the branches of this instrument is to be carried into each portion of intestine, so as deeply to embrace the projection for the extent of an inch or an inch and a half. Pressure must then be sufficient to determine mortification of the parts and so stop the circulation immediately. The mechanism of this process is easily conceived. The peritoneum is necessarily brought in contact with itself on the circumference of the enterotome. Eliminatory inflammation is gradually developed and transmitted to some lines beyond. Solid adhesions are the inevitable result, and no perforation on the side of the peritoneum is then to be dreaded. In proportion as the eschar is detached the instrument becomes more and more movable, and comes away when it is entirely insulated. If the compression was not sufficiently powerful at first, the blood might still be introduced between the blades of the forceps, in which case gangrene would not take place. The external peritoneum might not have inflamed to the point necessary to produce proper adhesions. A perforation towards the cavity of the abdomen would be to be apprehended, and the detachment of the morbid septum not effected. The pain besides would be more violent, and the cure slower even if it ever took place. This method, employed more than twenty times by M. Dupuytren, since by

M. Hey of Bonneval, Lallemand, Delpech, and other practitioners has not as yet occasioned any serious symptoms except on three or four patients. When the perforation has been effected the matters are drawn to the inferior intestine, and the stools become regular. Every day less is passed by the wound, which rapidly contracts and is soon reduced to a simple fistula, if not wholly cicatrized. Fever rarely supervenes; colics or symptoms of slight inflammation of the intestine or peritoneum are the only unpleasant symptoms that have been observed, and most frequently the patient scarcely suffers from the operation.

Some persons have nevertheless attempted further improvement by modifying the enterotome forceps. Thus M. Liotard in his thesis proposed an instrument, a kind of punch-plyers, which is to cut out a circular portion of the morbid septum, without touching its free edge, and so that there will result an opening in some measure similar to that of a natural intestine. This process, which is unapplied as yet, would have the disadvantage of not suiting every case, of exposing to be cut some sound portions of a free loop of intestine, which may have placed itself behind or between the two branches of that of which the septum is to be perforated, and finally of being too difficult of execution, for the plates of M. Scolard are too large to be easily introduced through a preternatural anus, and through the ends of intestine themselves, which in this case are usually very much contracted. M. Delpech has made use of an instrument which acts pretty nearly by the same mechanism as that of M. Liotard. It is a long forceps terminating in two knobs, a little elongated, similar to the shells of a walnut, the circumference slightly concave in the direction of their length. These are separately introduced. As they at first compress only at their beak, they divide the septum but by degrees and from behind forwards, while with the enterotome of M. Dupuytren, compression being generally stronger the nearer the heel of the instrument, it is from before backwards that gangrene is produced. M. Delpech has well perceived that his forceps, useful perhaps in particular cases, is incapable of generally supplying the place of that of M. Dupuytren. It may offer some advantages I suppose when the partition is extremely long and deeply seated, or when to reach it we are obliged to pass through an irregular passage more or less sinuous; but these are circumstances which always escape from the rules of a general description, and must be left to the skill of those who meet with them.

In this method, as in every other, two things are to be separately considered, the end and the means. It appears to me that there can be no variety of sentiment at present except upon the last, and there is no reason why attempts should not be made to modify them further. Since, by depressing the projection in the preternatural anus a passage is opened, why not make this depression by a canula, which will at the same time allow of cicatrization of the exterior division? This advice was given by M. Colombe in 1827; and M. Forget informs me that since 1824 he has advanced a similar suggestion. M. Colombe directs a large canula of gumelastic two or three inches long to be placed in the two ends of the intestine, a canula slightly curved which will rest by its concavity on the free edge of the septum, and will carry on the middle of its convex side a thread intended to hold it until the wound is almost entirely closed, or the course of matters so completely re-established as to leave no longer any fear of their escape externally.

At the first glance, this method appears to deserve consideration, and seems specially suitable for cases in which the re-entering angle formed by the mesenteric wall of the intestinal loop is very open, or the projection is not very great, particularly for those in which the intestine has not been destroyed in the whole of its circumference; but it is to be feared that in others it will be insufficient, and must be counted inferior at least to that of M. Dupuytren. I will add, that to have great chance of success it is necessary to use a very large canula, the introduction of which will at first be attended with considerable difficulty. I practised it in August 1831, at La Pitie, and the patient died three days after of intense peritonitis. The intestine was perforated behind and the canula engaged in the orifice. Whether this be referred to cause and effect or to simple coincidence, such a result does not argue much in favor of the method.

Operative Process.—When the surgeon has decided upon attempting the cure of artificial anus, he must first think of surmounting the obstacles which in some cases oppose the introduction of the *enterotome.* If the integuments have not been widely opened, or if from any cause sinuous passages, or stercoral fistulæ are observed in its vicinity; if a tumor, sinuses, or erysipelatous inflammation exist in front of the canal which it is proposed to pass through, doubtless the first step should be to remove these various obstacles, either by incisions and even proper excisions, or by general or local bleedings, emollient or laxative topical applications, baths, lotions, &c. In a patient, in whom the strangulated hernia had never been operated upon, I saw five or six openings and a tumor as large as the fist form in front of the ring, caused by thickening and chronic phlegmasia of the skin, the cellular or adipose tissue, and the different lamellæ contained in the inguinal canal. I was therefore obliged to circumscribe this mass by two crescentic incisions, and in removing it, to penetrate as far as the root of the spermatic cord in order to display the intestinal orifice. In such a case, it should be recollected that the operation ought to be performed at two different periods; that is, before proceeding to use the enterotome we should wait till the preparatory wound has healed. At other times we are obliged to dilate for a week or two the preternatural anus itself. In some cases the cutaneous orifice is so far from the intestine that there is great difficulty in penetrating the latter. The perforated portion may besides have remained crooked, and be bent either in the interior of the canal itself or behind the ring, forming folds which may have contracted adhesions among themselves, and may thus give rise to difficulties which it is necessary to overcome before proceeding further. The inferior end, which is always strongly contracted, may again be placed above the upper, around which it may be twined, of which an interesting case may be seen in the memoir of Mr. Delpech. Although very rare, the obliteration of this part of the alimentary tube, however old the disease may be, is yet possible; a fact observed at the Val-de-Grace, on an old man, affected for forty years with accidental inguinal anus, demonstrates it beyond dispute; so that it is well to remember it before carrying the forceps upon the wall of partition which it is intended to destroy. If then the wound is situated at any considerable depth, and there is any doubt of the nature of the relations existing between orifices of the abnormal anus, we should endeavor gradually to dilate the passage which leads into the superior intestine, and do the same with the inferior by the introduction of long

tents, bougies, sounds, gumelastic canulas or pieces of prepared sponge, and never have recourse to the enterotome, before being able with the finger to ascertain the position of the parts and the relation of the septum with each end of the intestinal tube.

When we have arrived at this point the operation itself may be performed. The patient is placed as for celotomy. The fore finger of the left hand serves as a guide to one of the branches of the forceps, which it conducts under the inferior face of the projection which is to be destroyed. An assistant is to keep this in place while the operator in the same manner introduces the other into the upper end of the affected tube. He then takes hold of both, turns them on their axis so as to be able to close them, carries his finger again nearly to their extremity to ascertain how far they embrace the promontory, and to push them without fear as far as he wishes the consequent mortification to extend. The screw, or any other means intended to bring them together, is then applied upon the extremity of their handle, and compression carried to a degree, as has been already said, proper to suspend circulation and vitality in the septum which they grasp. It only remains to surround them with charpie and compresses and fix the whole with a bandage, and the operation is finished. The charpie and other dressings are to be renewed as often as the flow of matters is necessary, taking every precaution however not to derange the position of the forceps. Any symptoms that may be developed are to be met by the requisite treatment. As soon as any gurgling is heard, and the least tenesmus manifested, injections more or less stimulating are positively indicated, especially when the instrument begins to get loose, and if the separation of the eschar seems already to have taken place. The remaining treatment has nothing peculiar. The patient should preserve the horizontal position, from time to time take a laxative, have frequent recourse to clysters, and take all kinds of nourishment. By this means the external wound is often entirely closed, although in general some weeks, and even in some cases it appears months are necessary to accomplish it. There are persons also in whom this opening reduced to a simple fistula resists every treatment, and obliges the surgeon to employ only palliatives. To this obstinate continuance, which there is nothing apparently to keep up, we have opposed, says M. Dupuytren, without any great result, powdered colophony introduced into the fistula, cauterization of its edges with nitrate of silver, their approximation by adhesive strips, excision of their edges formed of the skin and mucous membrane, in fine their union by the twisted suture; we have even conceived the idea, in order to keep them in contact, of approximating them by means of two oblong pads fixed to a girdle, and connected together by two screws. This apparatus had no better success than the others. It is therefore, an infirmity which requires new researches, new modes of treatment, and against which we are obliged to confine ourselves to the use of means to preserve cleanliness. As it only occasions a slight oozing, it is enough to keep a little soft charpie upon the sore, and to renew it several times a day, in order that the mucosites and other intestinal fluids which it imbibes, may not have time to become decomposed or fetid by their accumulation. In this case it is proper in my opinion to try the processes borrowed from rhinoplasmus, after the manner of Dr. Jameson or M. Collier, unless we choose first to make trial of dissection and elongation of the edges of the abnormal anus. In case of a preternatural anus, the cure of

which cannot or should not be attempted, the best means to be employed is the box invented by Juville. Any other vessel constructed on the same principles will serve the same turn; and may be found in plenty with truss-makers or manufacturers of gumelastic surgical instruments.

B. PARTICULAR HERNIAS.

ARTICLE I.

Inguinal Hernia.

§ 1. *Anatomical remarks.*

The points of the abdominal wall that give passage to the viscera in cases of inguinal hernia, are bounded below by the ligament of Fallopius and the os pubis, above by the inferior edge of the transverse muscle, and internally by the tendon of the rectus. Poupart's ligament extending from the anterior superior spine of the ileum to the spine of the pubis, represents a cord to which we may give three edges; first, inferior, which is continuous with the aponeurosis of the thigh, and which we shall have occasion to study hereafter; the second, superior and subtegumentary, which receives the aponeurotic fibres of the external oblique muscle; the third, posterior or peritoneal, from which arises the *fascia transversalis.* The cutaneous margin, which is so completely continuous with the external aponeurosis of the abdomen that many authors have regarded it as its termination, requires to be distinguished from it. This aponeurosis, in fact, is constituted of solid fibres united in little bands, which sticking upon Poupart's ligament form with it an angle the more acute the nearer they approach the symphisis. The separation of its fibres into two divisions in arriving at the body of the pubis, forms the external opening of the passage through which the spermatic cord passes, and this opening is not owing to the division of the internal extremity of the ligament of Fallopius. These fibres are besides supported by a kind of web of condensed cellular tissue which is found in the composition of all aponeurosis, and crossed at right angles by other fibres much more sparse (and sometimes even entirely wanting, especially in early life); which when quite numerous give it the appearance of a distinct tissue. The posterior edge of the ligament of Fallopius is continuous with a lamina upon which there has been much discussion of late years, and which received only cursory notice until it was described by Sir A. Cooper. From it the *fascia transversalis, ascendens, reflexa,* &c., ascend behind the posterior face of the internal oblique muscle, arrive on the corresponding face of the transversalis, and extend transversely from the spine of the ileum to the rectus abdominis. Its fibres are parallel to each other, and are directed a little towards the median line in its external half. It is very thin, and most frequently reduced to the form of a cellular lamella in the latter direction, but is more solid and incontestibly fibrous in its internal moiety. Its aspect varies singularly according to the subject, age, and sex. In infancy and in the female it can scarcely be distinguished from the cellular tissue which usually covers its two faces, while in the adult man, and especially in a lean subject, it forms an aponeurosis, the existence of which cannot possibly be called in question. Its presence in

this place is but the repetition of the aponeurosis of the external oblique muscle reduced to its elementary condition. Holding in some sort a middle place between the cellular tissue and fibrous layers proper, the descriptive details of it which have been given are the less justified, as every large muscle is covered with a lamella nearly similar, either externally or internally, when they have not a true albugineous covering. It is further necessary not to confound it with the peritoneal cellular tissue, from which it is as distinct as the aponeurosis of the external oblique is from the *fascia superficialis*, with which the *fascia transversalis* has been incorrectly compared. The opening which it presents a little without the middle of its width, gives passage to the spermatic cord, rests on Poupart's ligament, and sometimes extends so high up as to form an actual division between its two halves. In some subjects the internal moiety of this *fascia* is really all that can keep the name of aponeurosis, the other portion is so thin and analogous to cellular tissue.

Between these two fibrous layers are found the inferior fibres of the transversalis muscle, and particularly those of the internal oblique, some bundles of which arise from the gutter between the two edges of the ligament of Fallopius and form the cremaster muscle. Of late years surgeons have agreed that the opening which gives passage to a bubonocele is not a simple ring as formerly described, but an actual canal, having an anterior and a posterior orifice and an intermediary space. This disposition, of which Riolan the younger had an imperfect idea, as had also Gimbernat, who pointed it out positively in 1787, and afterwards in 1793, seems nevertheless not to have been known to Richter, nor the surgeons who wrote before Scarpa, A. Cooper, Hesselbach, &c. At present, as the fact may be confirmed by every one on the dead subject, its existence is not thought of being called in question, though there are some practitioners who are not willing to give it the name of canal.

Supposing the spermatic cord removed, we may accord to the inguinal canal, first, an anterior or external wall formed by the aponeurosis of the external oblique, some fibres of the internal oblique and loose lamella of cellular tissue; secondly, a posterior wall formed by the internal portion of the *fascia transversalis*, thirdly, a superior side belonging to the edge of the transversalis muscle or to the union of the two aponeurosis just mentioned; fourthly, an inferior wall, which is only the internal third of the groove formed by the separation of the external aponeurosis and the fascia transversalis. Its direction is oblique from behind forwards, from without inwards, and a little from above downwards. One of its two openings corresponds to the cavity of the abdomen, the other to the integuments. The first ordinarily presents the form of an ovel, its base resting upon the ligament of Fallopius, while its apex is prolonged towards the transversalis muscle; its internal margin, the firmest and most prominent, has received from some authors the name of falciform edge; the external, a little more depressed and less apparent, seems in the greater number of cases to be blended with the corresponding wall of the canal, in which it is insensibly lost. The second, or the ring of the external oblique, is triangular and formed below by the edge of the pubis, within and above by one of the strips of abdominal aponeurosis, and without by the termination of Poupart's ligament as well as another bundle of the aponeurosis of the external oblique. Surgeons usually give the name

of pillars to its two principal edges, and make them rise from the bifurcation of Poupart's ligament, which as we have seen is a material error. The internal pillar goes to be blended or crossed with its fellow before the symphisis, and belongs entirely to the aponeurosis, while the external is alone formed by the ilio-pubic ligament; besides it is completed superiorly by the termination of another band of the external fascia. The superior angle of the ring extends sometimes very high and very far outwards, while on other cases it is much depressed and as it were destroyed by the transverse fibres, which convert into a distinct tissue the external fibrous layer of the abdomen. Hence a great variety in its dimensions, and a greater or less disposition to strangulation in hernias formed by this passage.

In a well formed adult, the passage of the spermatic cord is an inch and a half to two inches in length, measured from one of its openings to the other, and three inches including the openings themselves. In some subjects I have found it half an inch to an inch longer, while in others it has been so short that the external border of its scrotal orifice was placed, as it were, opposite the internal border of its abdominal orifice. In childhood it scarcely exists, so that to escape without, the organs have only a ring to pass through instead of a canal, as its two openings correspond and no distinct wall can be recognized in it. This disposition is very easy to be conceived. While the angle formed by the edge of the coxal bones is widening and enlarging, the spine of the ileum is necessarily being removed from the pubis. The organs contained in the cavity of the greater pelvis are drawn outwards to a distance greater as the pelvis becomes larger; whence it results that the opening in the *fascia transversalis*, which must follow this eccentric movement, leaves by degrees the level of the ring in the external oblique which remains fixed on the pubis, and these two orifices separate from each other, as two plates which are made to slide over each other in opposite directions. This kind of movement, this crossing of the two principal openings of the inguinal canal must be therefore much more marked in the female in whom the cristæ of the ilia are usually very far apart, than in the male in whom the fibres retains through life some of the characters which it possessed in infancy. It is easy to see therefore how the organs have at their first deviation more difficulty in traversing the inguinal tract, after it acquires the form of a canal than while it remained in the state of a simple ring, and that this difficulty is greater as these openings become more distant from each other. One consequence to be drawn from this fact is, that bubonocele should be more common in children than in adults, in man than in women, and that every inguinal hernia developed in youth, which is kept reduced for some years, finding a canal or two walls kept in contact by pressure, substituted for an annular opening, may be thus radically cured; while after the growth of the subject the reduction of the hernia would not give the same chance of success. When it exists for a long time, the presence of the viscera in the groin frequently brings back this track to its primitive form, by enlarging the ring in the external oblique at the expense of its external semi-circumference, while on the other hand it dilates the orifice in the *fascia transversalis* by pressing back its internal edge. It is a kind of Z, which is to be made straight by drawing upon its two extremities, so that the canal disappears in a great measure, and often becomes a real circle again, as in the child. The inguinal tract and its pubic opening are cover-

ed in front by cellular tissue and the skin. In the first, run some branches of the cutaneous and of the superior external pudic arteries. Behind, it is also covered with two layers; the cellular tissue and the peritoneum are introduced with the cord through the opening of the transverse fascia into the inguinal canal and thus arrive in the scrotum, so that even without hernia there is found in it, first, a prolongation of peritoneum lined externally with its *fascia propria;* secondly, the vas deferens, the spermatic vessels, and what is called the sheath of the cord; thirdly, the tunnel-formed prolongation of the *fascia transversalis,* which their parts bring with them supposing that any power whatever has drawn them out from the interior of the abdomen.

Between the peritoneum and the posterior face of the canal, or in the substance of the fascia propria, there are organs which it is important to notice; the *epigastric artery* for example, which after rising from the external iliac at the point where this vessel enters the crural canal, is directed inwards and downwards, then upwards around the inferior and internal part of the cord, or the inferior and internal semi-circumference of the abdominal orifice of the canal, in order to reach the posterior face of the transversalis muscle, and gain the external edge of the rectus, penetrating the fibres and terminating above the umbilicus by anastomosis with the internal mammary and the inferior intercostals. This artery, the volume of which is about that of a small quill before reaching the abdominal muscles, gives off some branches worthy of notice, although generally very small. It detaches one near its origin which is soon divided into two branches, one of which engages in the crural canal while the other runs towards the obturator foramen. A little further off another is given off, which almost immediately enters the inguinal canal, follows its internal wall, and is found in the scrotum in the substance of the cremaster muscle; this last branch ordinarily furnishes another, which runs transversely behind the body of the pubis, and anastomoses with its fellow of the opposite side. Lastly, a third arises a little higher up, is also directed transversely inwards, and is of no consequence in surgery unless it attain a large size and the hernia is formed inside of the epigastric. With respect to inguinal hernia, the sub-pubic artery presents varieties of which the surgeon should be aware. I do not refer to its arising from the iliac a little higher or a little lower; this will be noticed hereafter; but I cannot pass by in silence two or three anomalies recently observed. In one which has been drawn by M. Hesselbach, this artery comes from the hypogastric, and instead of running obliquely inwards rather tends to incline slightly outwards after going beyond the line of the inguinal canal. In a subject examined by M. Michelet at the Cochin hospital, it arose in the thigh from the internal circumflex, and ascended to take its usual place between the peritoneum and the abdominal muscles. Quite recently M. Lauth wrote to me that he had found two on the same side, one coming from the hypogastric, the other from the external iliac; one without, the other within the line of the spermatic cord.

As it forms a certain prominence behind the *fascia transversalis,* the epigastric artery gives rise at this point to a fold which divides the posterior wall of the inguinal passage into two very distinct excavations, one of which I propose to call the *external inguinal fossette,* and which corresponds to the entrance of the canal; the other which it is necessary to call the *middle fossette* or depression, which is traversed by the organs in direct inguinal hernia, and

corresponds to the external part of the ring in the external oblique. Within this excavation, and always in the substance of the *fascia propria*, is found another prominence, a mere vestige of the umbilical artery, which separates the middle fossette, of which I have just spoken, from a third depression, bounded inwardly by the fundus of the bladder or the external edge of the rectus muscle, and which I would call the *internal inguinal fossette* in which the viscera have also been seen to engage and form hernia.

The concomitant veins of the umbilical and epigastric arteries are in general of too small a size to require any particular notice. However, it may happen that a larger branch than usual may arise from the hypogastric or internal iliac, and ascend independant of the epigastric veins behind the muscles, to reach the neighborhood of the umbilicus, and anastomose with the umbilical vein. Three anomalies of this kind have been published laterally by Manec, Meniere, and Clement. The abdominal serous membrane extends as far as the testicle, under the name of the tunica vaginalis, and represents a canal, which after some time is closed and transferred into an impervious cord, and in the end is blended with the surrounding cellular tissue, and converts the tunica vaginalis into a sack without an opening, leaving at the same time a tunnel-formed depression of greater or less depth at the posterior ring of the inguinal passage. However, instead of being thus obliterated, this prolongation may only contract and remain a little canal more or less dilatable until adult age. As the spermatic vessels and the vas deferens are placed beneath the peritoneum, and enter the inguinal canal supported by the internal and inferior edge of its abdominal orifice, the prolongation must be naturally situated without and a little in front of the spermatic cord, so that the vas deferens is found within and behind. The spermatic artery is a little outwards and in front. The two corresponding veins are seen one within, the other without the artery, a little more in the rear and on the same plane with the vas deferens. The filaments of the trisplanchnic nerve, situated a little more superficially, are united with these several objects by means of loose lamellated cellular tissue. Still further outwards is the peritoneal prolongation, then the inguinal branch of the epigastric artery and the scrotal branch of the genito-crural nerve. Thus around the cord, taken in its whole, there exist, first, a canaliculate prolongation of the *fascia transversalis*, enveloping at the same time a similar prolongation of the *fascia propria*, the peritoneal filament and the various constituent parts of the cord itself; secondly, the envelope formed by the fibres of the internal oblique or the cremaster muscle; thirdly, issuing from the canal another sheath continuous with the circumference of the ring, and which is but a prolongation of the fundamental cellulo-fibrous tissue of the external aponeurosis of the abdomen; in the last place come the *fascia superficialis* and the integuments. Let us remark, moreover, that the whole cord twists a little upon itself in passing through the inguinal canal, and that the parts which at their entrance where behind and within, are in the end found in front and sometimes even on the external side.

Surgical Remarks.—The external inguinal fossette is evidently the point which offers the least obstacle to the viscera. It is through this therefore that hernias pass most frequently and with the greatest facility, until latterly these were the only hernias which occupied the attention of the faculty, and it is only within thirty years that it has been deemed necessary to give them

a particular name to distinguish them from those that follow another route. The term *external inguinal hernia*, proposed by Hesselbach, although generally adopted in France, is nevertheless not without its inconvenience. In fact, hernias may be developed still further without, and it is well known that Heister calls crural hernia, external inguinal hernia. After passing the posterior opening of the canal, if the hernia meets too great a resistance at the orifice in the external oblique, it may be kept back, and thus remain in the interior of the passage. Lecat seems to have had an idea of a case of this kind, and Mr. Lawrence and some other surgeons have positively observed it since. It is this that M. Boyer names *intra-inguinal* hernia. Arrested by the ring in the external oblique, and pushed by the action of the muscles, the organs may double themselves outwards or upwards, and ascend some distance in the very substance of the parietes of the abdomen, as Hesselbach seems to have experienced. Strangulation then will occur much more readily, for the angle formed by the change of direction in the intestine is of itself sufficient to produce it. It is only in cases in which the viscera have cleared the cutaneous orifice of the canal, that hernia is really complete; so that the name of *incomplete* inguinal hernia is more proper for it than intra-inguinal hernia. However, a case reported by Mr. Lawrence, proves that there may be at the same time a hernia without, and a hernia within the canal; or rather the hernia in this case was as it were divided into two parts by the ring in the external oblique. Instead of penetrating through the opening in the *fascia transversalis*, the organs have been seen to emerge without this orifice, separating the fibres of the external portion of the fascia, and falling afterwards as usual into the scrotum. M. Blandin asserts that he saw an example of it on the examination of a dead body, and that in the subject of which he speaks a fibrous band, two lines wide, separated the neck of the hernia from the abdominal orifice of the inguinal passage. In such a case the viscera would no longer have the *fascia transversalis* for an envelope unless they had carried it before them instead of separating its fibres. J. L. Petit long since noticed another variety of inguinal hernia. The organs escaped through a frayed portion of the external pillar of the ring. Arnault saw the same thing in a subject in whom two hernias existed at the same time, the one crural, the other a little more elevated, which were only separated by a *little fibrous band*. Many practitioners have disputed the existence of the variety mentioned by Petit, although Richter has formally announced it since; but a case observed latterly by M. Roux at la Charite, leaves no further doubt on this subject. I have met with it myself once in a young student of medicine. This young man had several times perceived a tumor which appeared to be in the groin, and was soon after returned. It was situated six lines exterior to the ring. Besides, when it is recollected that most of the bands of the aponeurosis of the external oblique leave between them a slight interval before attaching themselves to the crural arch, it is readily understood how the viscera, if arrested within by any obstacle, may succeed in forcing one of these interspaces, and in some measure create a new abdominal ring. Laennec cites a much more remarkable arrangement. He had to dissect the body of an individual who had died of the consequences of a strangulated hernia. The organs had escaped by the natural passage, and returned into the abdomen through an opening with-

out the aponeurosis of the external oblique. In a subcutaneous abscess Mr. Coffart found a long portion of epiploon above the crista of the ileum. In fine, J. L. Petit says, that he saw an inguinal hernia which was formed through the internal pillar of the ring, leaving the ring itself entirely free. The work of Juville on bandages contains a similar observation. However, this may be; and in all these varieties the epigastric artery remains on the internal side of the neck of the hernia. Contrary cases form another species, first described by Camper in 1759, afterwards by Cline in 1777, by Rougemont, Chopart, and Desault, but the characters of which were not well understood until after the labors of Hesselbach, A. Cooper, Scarpa, Lawrence, and J. Cloquet. Instead of following the inguinal passage, running obliquely inwards, as in external hernia, the intestines engage in the middle fossette between the epigastric and umbilical arteries, depressing, elongating, drawing, or perforating the internal portion of the *fascia transversalis*, that is, the posterior wall of the canal, and thus arrive directly in the ring in the external oblique, and fall as in the preceding case into the middle of the scrotum. As the epigastric artery remains externally, Hesselbach gave the name of *internal inguinal* hernia to this species of rupture, which has latterly been mentioned by several authors. Messrs. Lawrence and Hassenden have observed it quite recently in a patient who died in St. Bartholomew's hospital. Others have proposed to call it *direct inguinal*, in contradistinction to the preceding which they designate by the title of *oblique*. Some prefer calling it *ventro-inguinal;* but as all these denominations are more or less faulty, it is probable that the one founded on the relations of the epigastric artery will alone be preserved. It will also be seen that the spermatic cord is not in the same relative situation in the one of these cases as in the other; that external inguinal hernia must push it inwards and backwards; on the contrary, that internal hernia will almost of necessity throw it more or less outwards. It appears from an observation of Wilmer and another of A. Cooper, that hernia may also pass out by the internal inguinal fossette. It would be even curious to know if this is not the place in which inguinal hernias of the bladder and uterus sometimes take place? The *fascia transversalis* in its thickest portion is then depressed or frayed as before. To clear the ring the organs must follow an oblique direction from within outwards and from above downwards. I do not know what name it would be proper to give such a hernia.

C. *Infantile Hernia.*

In the adult inguinal hernia almost constantly pushes the tunica vaginalis inwards and backwards. In very early life things are different, it is in front that the serous tunic of the scrotum is situated. Hey, who first described this species of hernia, called it by the name of *hernia infantilis*, and that in which the tunica vaginalis remained behind, *virilis*. He met with it in several subjects, particularly in a child sixteen months old. It was strangulated in a child twenty-nine days old, whose case Mr. Hunt has since published, and in another fourteen months old successfully operated upon by Mr. Lawrence.

Hernia of the vaginal sac.—If the tunica vaginalis is not closed above, the organs will lodge there in preference; and the hernia which in this case is in immediate contact with the genital organs, takes the name of congenital her-

nia. The name is incorrect. The species of disease it designates may be manifested many years after birth. Hey, Dupuytren, Lawrence, and Roux have shown that the testicle long retained in the ring, may in descending at twelve, fifteen, twenty or twenty-five years of age, be followed by a hernia also enveloped by the tunica vaginalis. Moreover the viscera may descend in this tunic, although the testicle had taken its place in the scrotum at a very remote period. Hence, even a rupture; the possibility of which would doubtless hardly be admitted by many surgeons, but of which I have observed two cases which appeared to me quite conclusive. M. D. student of medicine, twenty years old, was all at once seized with violent pains in the groin on returning home one evening from walking with two of his companions; a strangulated inguinal hernia became manifest. By the operation which took place next day we found the intestine in contact with the testicle; the strangulation was produced by the external ring. The young man was completely and promptly relieved. No previous hernia had existed, both testicles had long been in their natural place. The tumor arose suddenly and immediately, became as large as the head of a fœtus, and yet the sac was formed by the tunica vaginalis. It would be in vain, it seems to me, in order to impair the value of this fact, to endeavor to maintain that a portion of intestine might be in the inguinal canal unknown to the patient, or that he was deceived as to the descent of the corresponding testicle. M. D. had rather a certain degree of leanness than *embonpoint*, and was in the habit of giving great attention to every thing that concerned his health. It is therefore certain that vaginal hernia may occur in adult man long after the descent of the testicle. Besides, here is another case verified upon the opening of a dead body. In 1829 there entered my ward at the hospital St. Antoine a young wine merchant, strong and of low stature, who the evening before had made a violent effort in attempting to lift a cask. Being questioned in every way he constantly answered that until then he never had a hernia. That for which he came to seek assistance was of the size of two fists, completely strangulated, and in the end required an operation. The intestine was contained in the tunica vaginalis and in contact with the testicle. The 'debridement' was successively performed upon the two orifices of the canal and the neck of the sac. An intense peritonitis caused death on the third day. On opening the body we found that the entrance of the vaginal membrane, frayed on three points of its internal semi-circumference, was torn behind at is entrance into the scrotum, that the inguinal passage preserved all its length and its obliquity, and in fine, that to escape, the viscera had been obliged to distend and enlarge forcibly the serous prolongation of the peritoneum, which was contracted but not entirely obliterated. Since this period a third case of the same kind has been published, obtained in the wards of M. Dupuytren. The young man, eighteen years old, affirmed that the testicle of this side had descended at the same time as that of the other. Another patient, twenty-one years old, who on mounting a horse perceived a vaginal hernia appear, although both his testicles were free, presents a fourth example. M. Lafond in his thesis says, that he saw a young ecclesiastic about twenty years old, whose testicle had not always been in the scrotum, suddenly seized with inguinal hernia, which became strangulated and required an operation, and which also was in the tunica vaginalis. At first view, it seems difficult to conceive of a hernia of

this kind in an adult. However, by remarking, as Hunter and Callisen and several anatomists since have observed, and as I have observed myself on two dead bodies, that the scrotal prolongation of the peritoneum remains sometimes pervious during life under the form of a little canal, that at other times also it only closes at its superior orifice in such a manner that the tunica vaginalis ascends into the thickness of the abdominal parietes, this fact will no longer be incomprehensible, and in nothing repugnant to reason, nor contrary to the most simple anatomical notions.

From what has been said, hernia of the tunica vaginalis presents three different grades; first, that which is formed in the fœtus in the first moment of existence, and this is properly congenital hernia, or the *elytroid* hernia of birth; secondly, that which arises from the arrest of the testicle in the ring, preventing the tunica vaginalis from closing above, and allowing the viscera to be engaged or even drawing them into it, when it finally descends, if it has contracted adhesions with them, or by merely preparing a sac for their reception: it is this variety, elytroid hernia of adolescents or adults to which M. Dupuytren wished to call the attention of surgeons, and which Lawrence, M. Roux, and others have noticed; thirdly, that which I have just mentioned, the predisposing cause of which is the incomplete obliteration of the cavity of that portion of the peritoneum contained in the inguinal canal. Inquinal hernia is much more rare in woman than in man, yet less so than is said or generally supposed, and is not attended with exactly the same characters as in the other sex. The canal which receives it being longer, much less in width and filled with the round ligament, which does not extend like the spermatic cord free beyond it, but slightly disposes the abdominal organs to issue by this passage, and much less, as the iliac fossa presents in its environs a much more favorable point for their passage. However, it must not be forgot, that the inguinal opening in young girls not being a canal but merely a simple ring, hernias of this description are quite as common in one sex as in the other. The round ligament, in penetrating the groin and the extremity of the labia pudendi, is sometimes accompanied with a peritoneal prolongation, known by the name of canal or ligament of Nuck, which has been considered as analagous to the tunica vaginalis. The fact is, that the intestines have been seen engaged in this appendix in young girls, giving rise to a hernia known by the name of *congenital hernia of girls*. It is perceived, that in adult age the same thing may happen if the ligament of Nuck remains permeable, but for the most part the organs will pass in front and outwards, carrying with them a real sac as in men.

§ 3. *Composition.*

The sac of inguinal hernia seems to be most easily torn. It was upon an inguinal hernia that the groom mentioned by J. L. Petit received a kick from a horse, and the rupture in question was produced. The case of rupture of the sac observed by M. Boyer, and published by Mr. Raymond, also related to inguinal hernia. It is the same with that mentioned by MM. Diveux and Plaignand, with a third case inserted in the Montpellier Collection of Theses for 1817, and a sixth met with by M. Darbefeuille of Nantes, which has this remarkable circumstance, that they were able to confirm the fact by

dissection of the dead body; and a seventh published in 1826 by M. Breidenbach of Heidelberg. Not only may the sac of inguinal hernias be torn and let the organs escape between the other envelopes of the tumor, but they may be ruptured also on the side of the tunica vaginalis, into which it has frequently opened, whether previously filled with fluid, that is, being the seat of hydrocele, or in its natural condition entirely free. M. Dupuytren has published several remarkable examples of this communication of the hernial sac with the tunica vaginalis, which he has observed sometimes below, at other times in front, and in some cases quite behind. It is evident that this rupture is calculated to cause strangulation without preventing its being at the same time otherwise developed, and which, if not foreseen at the time of operating, would expose the viscera to be penetrated before recognizing the sac. It is in inguinal hernia also that incomplete sacs are most frequently met with, which is explained by the seat of the organs, which in escaping from the abdomen, carry with them the adhesions by which they remain fixed in their natural cavity. Although most of the causes of the errors pointed out in the article on the operation in general may complicate its diagnosis, it is proper to say nevertheless, that ganglions, hydatids, and especially the adipose layers or tumors which have been mentioned, are more rarely found on its surface than on that of some other species of hernia. It should also be remarked that the sac of inguinal hernia is that which contains usually the most serosity, and is almost the only one in which it has been found to the amount of pounds or pints. All the organs contained in the abdomen have been seen in inguinal hernia; the cœcum frequently forms it. A number of cases prove even that it may enter the scrotum by the inguinal canal of the left side, and also that the sigmoid flexure of the colon is found sometimes in right inguinal hernia. The bladder penetrates it easily, as do also the ovaries and the uterus. Moreover Ruysch and J. L. Petit have observed in it the spleen, Reizelius the liver, M. Yvan has recently obtained at the Hospital of the Invalids a case which proves that the stomach itself may descend into the scrotum.

When the cœcum engages itself gradually in the groin, and the hernia acquires a large size, it is not rare to see it fixed there, as in the iliac fossa, by its posterior face, which may then become external and even anterior. This disposition Scarpa wished particularly to make known, and M. Sterlin (who gives the name of *acystic* to the kind of hernia) and M. Colson had it in view when they spoke of inguinal hernias deprived of their sac. It is evident besides, that if in this case the incision should fall without, and be carried upon an adherent part of the organ, there would be great risk of opening it, and the sac would escape the search of the operator if the precaution was not taken to look for it inwardly and in front. Although the sigmoid flexure of the colon has most frequently a mesentery at its posterior edge, it happens that in the scrotum it sometimes loses this fold, and finally becomes adherent there in the manner of the cœcum. Pelletan, Lassus, and several other practitioners have published examples of this. A remark which must not be forgotten is, that in hernia formed by the descending colon injections are not received but in very small quantity, as M. Berard has noticed; a peculiarity which may be explained by the length of the portion of intestine between the anus and the hernia. The bladder is the third organ which may

present in the hernia with a sac more or less complete, the same as the cœcum. The ovary and the uterus offer nothing peculiar, unless it is that their organs as well as the bladder are unlikely to cause symptoms of strangulation.

If the envelopes of inguinal hernia present fewer morbid anomalies than those of other hernias, they have on the other hand a certain number peculiar to themselves. Thus the spermatic cord contains adipose masses susceptible of hypertrophy, capable of acquiring an enormous size, and of simulating epiploic hernia. The serous or purulent cysts which are quite frequently developed in it, are calculated to cause several symptoms more or less analogous to those of strangulation. M. Marjolin, M. Roux, M. Ouvrard of Angers and others, have seen inflammation in the mass of the cord produce all the symptoms of strangulated hernia, and M. Briot of Besancon speaks of an imposthumated ganglion which was taken for an intestinal tumor until the close of the operation. M. Pecot mentions a fact which tends to prove that the pus of a diffused abscess, and an abscess from congestion, which following the inguinal passage makes a tumor in the groin, may deceive in the same way. The strangulation in these cases presents all the varieties heretofore noticed. In the most recent hernias, its seat is the fibrous ring in the external oblique. Sometimes, however, it is formed by the opening of the *fascia transversalis*, as I found to be the case in an adult male. At this point, and more frequently still at the neck of the sac, old hernias exist. In internal inguinal hernia, the viscera having escaped through a simple ring and not through a canal, the strangulation belongs almost always to the first or third species, whether the tumors have passed through the natural ring, or through a fissure in the internal pillar. If the hernias which pass through the external pillar become strangulated, they may present the three varieties of ordinary hernia; but if the intestine be arrested in the inguinal canal, or in the substance of the abdominal parietes, the strangulation will only be susceptible of the second or third variety. It was in inguinal hernia that Arnaud saw the epiploon form a kind of ferule which strangulated the intestine in the centre of the ring; and met with a loop of this organ so intimately adherent to the parietes of the inguinal circle, that it seemed impossible for him to insulate it. It was in this hernia in fine, that Pelletan, Lassus, as well as others and myself have met with epiploic masses under every form, and those numerous anomalies which have been noticed in treating of hernia in general.

§ 4. *Operation.*

As the integuments preserve in general a certain flexibility at this point, it is almost always possible to form a fold for incising them. Whether one or the other method be adopted, the incision should extend a half inch or an inch above the ring, and descend, unless there is a special contra-indication, to the bottom of the tumor, the great axis of which it should follow. This incision requires some precaution. The spermatic cord not having an invariable position, it would be easy in some cases to wound the vas deferens or the spermatic artery, as happened twice to Hey. In external inguinal hernia, it has been found passing in front of the tumor, so as to be external when arriving at its inferior part. Only some days since, I myself met with an

instance at La Pitie, in a patient who had an enormous hernia. In internal inguinal hernia, the same thing may happen but in an opposite direction; that is, the cord which is situated externally in issuing from the canal may gradually pass in front and then inwards to be continuous with the generative gland which is below, and also on the internal side. No doubt that in cases of this kind, the instrument will cut almost inevitably one of the constituent parts of the spermatic cord as happened to Dr. Hey, and as it was easy to do in the cases reported by Schmucker, Camper, Le Dran, Boudou, M. Fardeau, Scarpa, A. Cooper, Lawrence, Blizard, and some others. The tissues which separate the integuments from the sac are to be cut therefore with care, and in this respect at least it would be dangerous to follow literally the advice of Louis, who directs them to be penetrated unhesitatingly, and in some sort at a single stroke either with a sharp pointed probe or common bistoury. The division of these intermediatory layers is performed according to the rules laid down in the beginning. As to the sac, if it presents no wrinkle it is most prudent to enter it below, in front, and a little externally. After opening it widely upwards as far as the ring, the question is, whether it is indispensable to prolong the incision quite to the bottom. Some think not, and among others Dr. Hey, as well as Scarpa, fearing to touch the tunica vaginalis which is found on this side, direct at least a half inch to be left inferiorly. In reality, it is altogether a matter of indifference which of the two methods be adopted. When the hernia is congenital, the organs having widened and distended more or less the tunica vaginalis beneath the testicle, there are two obstacles to contend with in this point of view. If the sac is opened in its whole extent, the testicle tends continually to escape from the bottom of the wound, and may thus cause accidents. If the serous pouch is only incised in its superior half the genital gland will be much more easily retained; but the pus, if it form, will accumulate in the cul-de-sac preserved below, and may occasion other dangers. In this case therefore it would be best to make a large opening, then bring the edges of the tunica vaginalis in front of the testicle, and keep them there by one or more stitches.

On account of the vessels which it is important not to injure, inguinal hernia is one of those which are best adapted to dilatation, if this method is to be employed in any case. Theory directs incision, the only resource employed at present, to be performed in different directions according to the species of bubonocele. For example, it will be proper to direct it outwards on one of the points of the external semi-circumference of the ring, for hernias the neck of which is situated externally to the epigastric artery, that is, all that pass through the superior orifice of the inguinal canal; inwards, on the contrary, for internal inguinal hernia, and directly upwards when an epigastric artery exists in each side, as might have been the fact in the case reported by M. Lauth. This variable indication explains the so opposite councils given on this subject by the most commendable authors. Sharp, Lafaye, Pott, and Sabatier direct the incision to be made upwards and outwards, because the epigastric artery is commonly found on the inside; Verduc, Garengeot, and Heister, on the contrary, direct it to be made inwards, and Bertrandi, who saw the incision outwards produce a hemorrhage from the division of the epigastric artery which caused the death of the patient, gives the same advice. In fine, it was from fear of finding this

artery on either side that J. L. Petit, before Rougemont and Autenrieth, Messrs. A. Cooper, Scarpa, Richerand, and Dupuytren who follow the same practice, directs the incision to be made directly upwards. Desault and Chopart had, it is true, already remarked that the artery is on the inside when the cord is found behind or on the internal side of the tumor, and on the outside in the contrary case. But to fix opinion upon it, all the anatomical knowledge at present acquired by the immense majority of operators was necessary. To say that the incision should be made outwards when the hernia is external, and inwards when internal, would be of no avail unless it were more easy to distinguish these two varieties of the disease from each other. Besides when there are two epigastric arteries, or when this vessel arises from the obturator at a certain distance from the external iliac, it may very readily be found within the internal inguinal hernia, as is usually remarked in external inguinal hernia. The external epigastric artery in the subject observed by M. Lauth, might have placed itself external to an oblique inguinal hernia. In consequence of this uncertainty, Messrs. Cooper, Scarpa, Richerand, and Dupuytren justly prefer the method of Petit or Rougemont. By cutting directly upwards, say they, whether the artery be without or within, whether two or only one, whether the hernia be internal or external is of little consequence, no hemorrhage is to be feared, for this instrument divides the tissues in the known direction of the vessels. One objection presents, nevertheless, which is, instead of following a line parallel with the axis of the body the epigastric artery is directed obliquely inwards and upwards to reach the umbilical region, passing above the internal inguinal hernia; while in external inguinal hernia I have seen it bent downwards and inwards so that it formed in some sort a semi-circle, the superior extremity of which might be easily reached by a perpendicular incision. Then as it seldom fails to be more or less displayed by the origin of the tumor, it cannot be known whether it is really vertical or oblique in either direction. It would be equally possible to wound it by cutting directly upwards. I will add, that in internal inguinal hernia the pubic branch furnished by the epigastric would almost necessarily be cut, and in cases where its size is abnormal a troublesome hemorrhage would result, as seems to me to have occurred in the two observations noted by Mr. Lawrence, according to the commentaries of Duncan and Home. No method completely protects from hemorrhage, yet a wound of the epigastric artery is extremely rare. On what can this depend? First upon its being pushed aside by the neck of the sac, so that it is almost always situated two or three lines from the constricting circle, and most commonly this is the greatest extent given to the incision; secondly, when the strangulation is produced by the ring of the external oblique, the incision is made on a circle too far from the artery in question, to give rise to apprehensions of wounding it; whence it follows, that in a strict analysis the incision may be made in every direction without danger, provided too great an extent be not given to it, and thus the successes obtained at Vienna in the commencement of this century by M. Rudthoffer, who always cut inwards like Bertrandi, are not to be thought surprising. If we add that internal inguinal hernia is very rare, and that at present the outward incision is preferred in the great majority of cases, it will be understood why hemorrhage as a consequence of celotomy is so uncommon. However, as

it has been observed in several subjects, it is proper still to think of the means of avoiding it. But in every strangulation caused by the inferior opening of the canal, the incision from before backwards with a convex bistoury carried on the end of the finger as directed by Bell, whether imitating Messrs. Colson and Dellouey or M. Dupuytren, or, which is still better, using the point of a straight bistoury protected also by the finger, and which cutting from the free edge of the ring to a point more or less distant from its circumference, will be entirely free from all danger, since by conforming to these principles the instrument only penetrates as far as the posterior face of the *fascia transversalis*. In other cases, the *debridement multiple*, either with the straight probe pointed bistoury or the curved bistoury, allowing only one or two lines of depth to each incision, is well calculated if I mistake not to render a lesion of the epigastric artery almost impossible in any direction.

If notwithstanding all these precautions the artery has been wounded, of which Gunz heard too cases cited at Paris, as Bertrandi has proved by opening the body, and of which Richter, Leblanc, Hey, A. Cooper, Scarpa, Lawrence, &c. have quoted cases, what is to be done? Mr. Lawrence says that he found the epigastric branch completely divided on the body of an individual operated on for strangulated inguinal hernia, whose death had been produced by another cause. In a second case, the hemorrhage was suspended by a syncope, and the patient completely recovered; it remains however to inquire whether the blood really escaped from the epigastric artery. I have seen on a subject who had died in consequence of a penetrating wound of the abdomen, a complete division of this vessel from which the hemorrhage had been but trifling and was spontaneously arrested. It would then appear to be possible that this wound might take place frequently unknown to the surgeon. The ligature carried over the root of the artery as directed by Bogros, or through the wound by means of the several instruments proposed by Arnaud, Schildner, Richter, Desault, and many other practitioners, is too difficult of application and offers too little certainty to induce the attempt. It would be better to carry beyond the ring a kind of chemise or little sac of fine linen, the bottom of which is to be filled with soft charpie so as to form a tampon of greater or less width and thickness, by means of which the parts may be compressed from behind anteriorly, or from the peritoneum towards the integuments. It was thus that Mr. Hey and Boyer acted in the successful cases reported by them, or in their name.

Reduction.—This hernia is the most common, and it is this which most frequently contains the small intestine and the adherent parts of the large intestine; it is this that the direction given by M. Dupuytren applies, that if, as it sometimes happens, a membrane of new formation bridles the two ends of the visceral loop so as to prevent its elongation, it is necessary to destroy it. The best mode of returning the liquids, and the matters contained in this loop, is to embrace the mass with the palms of both hands, and press it gently until it is nearly empty. Here also care must be taken not to engage it between the peritoneum and the *fascia transversalis*, or in the substance of the abdominal parietes, for it is in this species of hernia that Le Dran, Callisen, De la Faye, Sabatier, Pelletan, Lassus, Hesselbach, M. Delmas, Mr. Lawrence, and myself, have observed the accident just noticed. No where in fact does the hernial passage present greater length, no where is there found so

much laxity in the cellular tissue which unites or separates the peritoneum from the muscles and the several constituent layers of the abdominal walls, no where in fine are bands more frequently found behind the ring, which are formed by adhesion of the cœcal appendix, a prolongation of the epiploon, by an accidental band, &c. It was in this moreover that Dr. Hey saw the sac divided horizontally into two distinct pouches by epiploon, an anterior one containing only serosity, and a posterior in which was contained the intestine. In a word, there is perhaps not a single anomaly or degeneration of the digestive organs or epiploon which has not been observed in the inguinal hernia. It is this besides which has presented those appendices in the form of a finger of a glove observed by Ruysch, F. de Hilden, Mery, and especially by Littre, and which belonged to a more or less elevated point of the ileum. When inguinal hernia is old and of immoderate size, as it is rare that the displaced viscera have contracted mutual adhesions which it is difficult to destroy, and are not in a measure agglomerated so as to represent in certain cases a mere fleshy mass, reduction ought not always to be attempted. If in this case the hernial envelopes have been divided in their whole extent only the free parts are to be returned, the rest is left without; the whole is to be covered with compresses soaked in emollient fluids, and the horizontal position, which the patient is to keep, brings them gradually within the ring if not into the interior of the abdomen itself.

It is in this variety in particular that Ravaton, Monro, Cooper, Crawther, Lawrence, Boyer, and Scarpa, after J. L. Petit, direct the incision to be made without, passing through the peritoneal layer, in the mode which M. Raphel supposed that he had originated, but which he only combined with the idea of Bell on removing the stricture in general. An incision is then made of some inches in length at the root of the tumor, to reach by degrees the neck of the sac without opening it. A grooved director is then introduced between this neck and the ring, which is then divided conformably to the rules already laid down. The strangulation being relieved, if the viscera can be returned into the abdomen without too much difficulty, reduction is to be attempted immediately. In the contrary case only those which yield readily are to be returned, and the rest supported or retained by a suspensory or properly arranged bandage. If after incision of the ring the strangulation remains, the neck of the sac should be perforated, a probe pointed bistoury introduced, and it should be divided with the usual precautions. The wound being closed by adhesive strips, generally cicatrizes after several days. In ordinary cases, when the organs are reduced, the sac is sometimes so movable, so slightly adherent, that it is possible to detach it, and form it into a small plug, as Garengeot says, and pack it into the ring or excise it.

Without returning to what I have said on this subject in the preceding pages, I cannot dispense with remarking, that if it is determined to follow it in inguinal hernia, it is necessary previously to be assured of the situation occupied by the *vas deferens* and the spermatic vessels. When inguinal hernia is direct, the incision should be parallel with the axis of the body. It should be oblique from above downwards and from without inwards, on the contrary when the tumor is external and of small dimensions; but when it is very large, it is found very well to give the incision the form of a half moon very much elongated, the convexity of which shall look upwards and inwards.

If the operation is performed on a woman, there will be no precaution required with regard to the cord. If in this hernia the ovary is retained near the ring, or has descended into the labia majora, of which Priscien, Veyrat, Pott, Lassus, Haller, M. Lallemand, and M. Deneux, have reported examples, and if the symptoms appear to depend in any degree upon its presence in the ring, the wisest plan would be to remove it. The uterus and the bladder may be reduced the same as the intestines, or will not fail to be spontaneously reduced in the end. Supposing the operation to have been performed to remedy symptoms produced by strangulation of the cord, observed also by M. Roux, the incision once made, nothing further is required. In case of hydatids and adipose tumors, excision of the morbid parts is to be performed; as also for lymphatic ganglions, if they chance to be developed in the inguinal canal.

A more embarrassing case than all these is that which arises from the presence of the testicle in the interior of the ring itself. Almost always in this case the genital gland is altered either in its conformation or its structure. If it is excised, the man is deprived of an important organ; if strangulation is merely removed, and the testicle cannot descend, the same symptoms may be reproduced, and the patient only receive temporary relief from herniotomy. Before the operation it will be the more difficult to determine with certainty, for a real hernia may be manifested in the place of the testicle as in a monorchid, of which M. Fayes has given an example. The practitioner is therefore to determine by the disposition of the parts, and the peculiar circumstances in which the individual is placed, on the plan which it is reasonable to pursue.

ARTICLE II.

Crural Hernia.

§ 1.—*Anatomical Remarks.*

Crural hernia was scarcely distinguished from inguinal, until the times of Barbette, Lequin, Nuck, and Verheyen. Its natural seat is the fold of the groin, and the opening which gives it passage is known as the crural ring or canal. By its superior edge, Poupart's ligament is continuous with the aponeurosis of the external oblique in the direction of the skin, and the *fascia transversalis* in that of the peritoneum, and is continuous below with the *fascia lata* towards the thigh, and the *fascia iliaca* towards the abdomen. At the middle of the ligament of Fallopius the crural aponeurosis separates into two layers. Its superficial lamina follows the course of the ligament until near the pubis, then separates from it, and is applied upon the pectineus muscle, and continuous with the *fascia pelvica.* The first, described under the name of the falciform process by the English surgeons, may be compared to a triangular lamina; of its edges, the superior unites with the ligament, the external is continuous with the primary aponeurosis, and the inferior or internal is free and more or less concave. The second, generally thicker, is continuous inwards and upwards with the expansion of the external pillar of the inguinal ring, or with Gimbernat's ligament, of which we shall speak presently. An oval opening, with its base inferiorly bounded by the free edge of the preceding layer, results from this disposition, and through this the internal saphena vein joins the femoral. Its plane looks inwards, forwards,

and a little downwards. About the middle of Poupart's ligament, the iliac aponeurosis dips down in the same manner as the inferior layer of the *fascia lata*, and thereby leaves between it and this ligament a kind of elliptical opening, which is the crural ring proper. This ring deserves all the attention of the surgeon. A small vertical septum usually divides it into two parts, the one external, in which is found the femoral artery and vein, the artery without and the vein within, filled only by cellular tissue and a lymphatic ganglion. To sum up; the anterior vacancy in the coxal bone is converted into two large foramina, by the ligament of Fallopius. This ligament, which is single until the *fascia iliaca* and the inferior process of the *fascia lata* separate, so as by being depressed towards the pubis, to bind the muscles and nerves of the iliac fossa, seems in fact, to bifurcate in order to form the crural canal, and thus separate the femoral vessels from the parts I have just described. Its horizontal branch gives rise, in approaching the symphysis pubis, to a membranous expansion, which is fixed to the crest of the pubis inclining a little towards the thigh, so as to become continuous with the inferior lamina of the *fascia lata*, and which is known by the name of Gimbernat's ligament. Continuous above with the external pillar of the abdominal ring, fixed below and behind to the crista ileo-pectinea, it presents outwardly a concave or crescentic layer, which reacts in an important manner upon the organs concerned in crural hernia.

Thus this canal is formed, externally by the separation into two lamina of the ligament of Fallopius and the *fascia lata*. The falciform aponeurosis, which is shorter as it approaches its internal side, constitutes its anterior wall. Posteriorly it is formed by the muscular layer of the crural aponeurosis. Interiorly it has really no wall, and is bounded by the free or sharp edge of Gimbernat's ligament. The femoral artery and vein fill its external half or third, and conceal its longest wall, and cause its inferior orifice to limit exactly its extent below. In its natural state this canal is filled with cellular tissue, which forms a communication between the *fascia propria*, or the lamellated lining of the peritoneum and the *fascia superficialis*, or the subcutaneous layer of the groin. A lymphatic ganglion, often of considerable size, usually closes its entrance, while its crural orifice is as it were curtained by a lamella of more or less density perforated for the communication of the superficial lymphatic ganglion, with the deep seated ganglia of this region. The saphena embraces the base of its orifice, the two extremities of which at the point seem to cross, passing one before the other, so that the posterior is continuous with Gimbernat's ligament, and the other with the pubic extremity of the arch. In passing through the crural canal, the hernial sac, already lined by the *fascia propria*, carries before it and appropriates the major part of the cellular tissue which is found there, is enveloped at its exit with the *fascia superficialis* and the whole subcutaneous cellulo-adipose layer, carries before it by the same reason downwards and inwards or outwards the lymphatic ganglia, which in some cases it only raises up, and which thus remain upon the surface of the tumor. Having arrived without, the hernia tends much more to the external and superior part than in the opposite direction, which is owing to the greater adhesion of the *fascia superficialis* inwards and downwards than towards the spine of the ileum, and the external portion of the ligament of Fallopius. It is thus that the hernia has been seen to return to within two or three inches of its exit in

the direction of the ileum. Examples of it have been reported by Arnaud, and more recently by M. Larrey. The sac runs along and without the femoral vein and artery. At its superior part it is in contact with the origin of the epigastric artery; which crosses its anterior and external portion more or less remotely in its passage to the peritoneal face of the abdominal muscles. In front, it is concealed first by the ligament of Fallopius, and a little further down by the falciform process of the *fascia lata.* Posteriorly, it is supported by the crista and triangular surface of the body of the pubis, the pectineus muscle, and more immediately by the posterior lamina of the crural aponeurosis; in fine, its internal side is embraced by Gimbernat's ligament. It must be remarked, besides, that in the male it is crossed obliquely by the spermatic cord, from which it is separated only by Poupart's ligament. The epigastric may arise an inch or an inch and a half higher than usual, and also may be furnished by the femoral artery below the ligament of Fallopius; which in the first case may cause this branch to be thrown on the internal side of the hernia instead of remaining externally, and in the second may bring the incision on some point of its external half, and almost inevitably cause its division. A second and more remarkable variety is one which I I have already described, in which the epigastric artery arises from the obturator at more than an inch from the external iliac, as seen by M. Hesselbach, and of which I also have met with an example. In this case no doubt the crural hernia would be external to it. The same would occur if the epigastric arose from the hypogastric, as I have seen it. A much more fearful arrangement might still be observed, if the hernia were formed in persons having two epigastric arteries on the same side, one coming from the iliac the other from the pelvic artery, as seen in the individual mentioned by M. Lauth. In man, especially, the neck of the sac would then have the pelvic epigastric within, and the iliac epigastric without, and the spermatic cord in front. A last anomaly which has not as yet been noticed, I think, is that for the knowledge of which we are indebted to M. Michelet, in which the internal circumflex of the thigh arises from the epigastric itself. The artery in this case may be found in front of the body of the hernia, crossing obliquely outwards and inwards, and reaching the adductor muscles of the thigh. But the variety of which most has been said, is that in which the obturator and epigastric arise by a common trunk from the external iliac; this is in fact the most frequent. The examinations which I have been enabled to make on several thousands of dead bodies, either in the hospitals, the dissecting theatres, or the school of practice, will not allow me to say that it happens once in three, five, or ten times, but about once in fifteen or twenty. It is moreover a fact more simple than is imagined. Before birth the obturator artery almost constantly arises by two roots, one coming from the hypogastric, the other from the epigastric; but the epigastric root becomes soon obliterated, the hypogastric remains, and definitely forms the vessel. If the contrary happens, the anomaly in question is observed.

Many practitioners have thought that in this case the neck of the crural hernia would have the epigastric artery external to it, and the obturator in front and within, so as to be surrounded with an almost complete arterial circle. As the epigastric trunk is placed between the peritoneum and the *fascia transversalis* or the ligament of Fallopius, if the obturator comes from

it, it is necessarily situated in the substance of the *fascia propria*, and in order to reach the sub-pubic foramen, it must follow the inferior semi-circumference of the crural canal. The viscera in escaping, having from this cause almost necessarily to throw it back, do not appear to run any risk of bringing it on their anterior face. I have not moreover as yet learned that a wound of it has been verified by examination of the dead subject, although it is said to have occurred several times in persons who have survived.

For the sole reason that the iliac artery in entering the ring divides this opening into two parts, and that the epigastric artery is detached from its internal or anterior part, there must exist another point externally of little resistance. By introducing the finger it is soon ascertained that it is really possible to pass thereby from the interior to the exterior of the abdomen; whence it seems to result that the hernia must sometimes be formed on the iliac side of the epigastric vessels. An external crural hernia therefore, and an internal crural hernia may be admitted. Only a single example however, has been given of late, and that by M. Cloquet; Arnault, most of the pathologists of the last century, Sabatier, and M. Walthier say, indeed, that in issuing from the abdomen the intestine passes obliquely inwards on the anterior face of the crural vessels, and consequently leaves it to be understood that the epigastric artery remains on the internal side of the neck of the sac; but on this subject they are confined to mere assertion, and there is no proof that they positively established the fact by dissection. Femoral hernia is not enveloped with as many laminæ as bubonocele. There are found only the peritoneum, the *fascia propria*, and the *fascia superficialis*, blended into a cellular-adipose mass, and the integuments. It is in this layer, intermediate to the skin and serous covering, that are found lymphatic ganglions, sound or diseased, enlarged, indurated, swollen in any manner, inflamed, or suppurated; hydatid cysts; abscesses, hot, cold, or from congestion, which sometimes surround a crural hernia, so as in some cases to render the diagnosis so difficult, and the operation so delicate. It was there, no doubt, that the pus collected in the two cases of cold or congestive abscesses mentioned in the thesis of M. Bayeul, which were mistaken for hernia. In this layer also the veins which return from the abdominal integuments are observed as well as the corresponding arterioles, and where are developed the tumors or adipose layers which I have pointed out in treating of hernia in general. As to the saphena vein, although situate in the intermediate layer, it is always thrown behind and below the tumor.

The opening which gives passage to crural hernia is so firm and solid, the tissues which receive and envelope it at the thigh have in general so much resistance, that it rarely acquires much volume. It is compelled to pass through an orifice deeply situate, and is liable to be stopped in the canal itself either above, at its middle, or at its femoral orifice, and its existence is therefore often difficult to be ascertained in fat subjects, particularly in women in whom it is so frequent. The same causes, as may be supposed, render the operation more troublesome than in inguinal hernia. It is besides owing to the narrowness of the passages and their want of extensibility that this hernia is so easily strangulated, and so difficult of reduction when there is the least constriction. In its interior, the same organs have been found as in the neighboring hernia, with the same anomalies, and the same pathological alterations. It is subject to

remark however, that its sac, generally thinner than that of oscheocele, contains usually but very little serosity, sometimes but a few drops, and often none at all. Nevertheless there have been cases in which several ounces were found within it, that is an excess as I have noticed in supra pubic hernia.

§ 2. *Operation.*

Celotomy of the hollow of the groin requires more precautions than that of the scrotum; first, because we more readily reach the sac when no complication exists, and because in the contrary case we have all the diseases that may be manifested in this region to distinguish from the hernia itself; again, because the sac being very thin and often blended by its external face with the surrounding cellular tissue, is liable to be opened before it is perceived, and containing scarcely any serosity renders lesion of the intestine very easy; in the third place, because we must go to a great depth, and incise parts almost necessarily surrounded with bloodvessels.

The incision of the integuments should and may almost always be made in the direction of the inguinal groove, and of the great diameter of the tumor at the same time. A simple incision is in general sufficient; however, if the hernia is very large and there is difficulty in laying bare its neck, there is no objection to converting this first division into a T incision in the manner of M. Boyer, by making another cut with the bistoury on the superior lip, or on the other, as there may be occasion to lay bare the internal or external side of the canal.

There is no reason why in every case a T incision should be made, the vertical branch of which is turned upwards, as directed by Sir A. Cooper, in order to run no risk with the internal saphena vein. The crucial incision directed in the Clinique of Pelletan, which M Dupuytren has often employed, can be but very rarely indispensable. But if there is good reason to have recourse to it, the fears of the English surgeon in respect to the saphena should by no means be an obstacle, for this vein is always placed beneath and behind the hernia. After opening the sac, it is as rare that we are to reduce the organs without incision as M. Boyer remarks, as it is common to see the intestine excoriated, ulcerated, or perforated in the portion which suffers the constriction. The stricture being in general caused by the sharp edge of the falciform process of the *fascia lata*, or the concavity of Gimbernat's ligament, the circle embraced by these two parts must first be examined. Ulceration existed in this place with the patient operated upon in my presence by M. Wessely, with a woman upon whom I operated myself, and with several individuals operated upon by Rona, Boyer, Lawrence, &c. The attempt must not be made, therefore, to reduce the parts before bringing out the portion which was contained in the canal; consequently, incision without opening the sac is not applicable in this case. On account of the danger of cutting the structure in crural hernia, dilatation has been thought of. Externally it is said you have the epigastric artery, above the spermatic cord, within you will wound the obturator if it arise from the epigastric. Happily these dangers are much less in practice than in theory. Sharp cut outwards and upwards, and although he operated on a great number of subjects we do not see that he ever happened to wound the pudic artery, the tying of

which by the way he considered very easy. Pott cut upwards, and the spermatic cord does not appear to have been wounded by him. Since Gimbernat, most surgeons cut inwards, and there is no proof that the sub-pubic branch has ever been divided in this manner. It is sufficient however that the thing be possible, not to neglect the means of avoiding it with most certainty. The process of Sharp is evidently the worst of all. M. Dupuytren, who appears to have reproduced it and conformed to it for a long time in his practice, has modified it in such a manner that it is no longer attended with the same dangers. This surgeon carries the edge of his curved bistoury reversed on the external edge of the opening for the saphena between the laminæ of the *fascia lata*, so that he cuts the tissues from before backwards or from below upwards, and thus destroys the strangulation before arriving at the place occupied by the artery to be avoided. In this, his method has but one inconvenience; which is, that it is not applicable to a stricture depending on the neck of the sac. It may also be applied upon every other point of the ring; but as the incision of the falciform process generally relaxes the whole extent of the opening, it has the advantage of being sufficient in the greater number of cases. The incision upwards and a little inwards is not formidable in woman when there is no vascular anomaly; in man on the contrary it may lead to a wound of the spermatic vessels. Arnault says he was witness to an operation in other respects performed very well, and of which the patient died in consequence of hemorrhage from the spermatic artery. Scarpa took pains to demonstrate that it is almost impossible to cut in this direction without incurring the danger pointed out by Arnault. Experiments tried by the latter in presence of Bassuel, Boudou, &c., and the plates of the learned anatomist of Pavia tend in fact to prove that by cutting the ligament of Fallopius from below upwards to the extent of two or three lines, the spermatic artery is almost inevitably wounded. Happily, chance or circumstances deceived these observers, and their fears are really exaggerated. First, it is not correct to maintain with Scarpa that the spermatic cord rests immediately on the bottom of the gutter of Poupart's ligament. Some muscular fibres, and a cellulur tissue sometimes quite abundant, usually separate them. It is not under the edge of the internal oblique but rather between its fibres that the cord passes. Besides, this ligament has four to five lines of height in the internal half of the ring. Outwards it would be entirely divided before running any risk, and this is never indispensable. When we give from six to eight or ten lines of extent to the incision, the danger which alarmed Scarpa and other modern surgeons cannot be denied to exist; but at the present day, as the cut is never more than two or three lines in length these fears are without much foundation. The case reported by M. Lawrence would be moreover further proof of this, for notwithstanding the complete division of the external pillar of the external oblique, the cord was not touched in the subject of whom he speaks. Besides, is it very true that an artery of as little importance is that which goes from the epigastric to the scrotum, or that the spermatic itself is capable of occasioning so dangerous a hemorrhage? It is outside of the peritoneum too that it would be found divided, and on this supposition it does not appear that, either by means of a ligature or suture, plugging or compression, it would be very difficult to obliterate it. And might not Arnault have been deceived as to its being hemorrhage under which the individual sunk whose case he relates? Were there not in this case some particular circumstances which he neglected to mention?

Gimbernat, whose labors had already been made known at Montpellier in 1788, by M. Purcel y Venuales, having studied better than his predecessors the anatomical arrangement of the passages, thought that the danger in the process of Sharp and lesion of the cord might be avoided by cutting inwards. His end being to separate with the bistoury, curved or straight, the triangular expansion to which his name has been given, from the inferior edge of Poupart's ligament he carries the instrument to the superior part of the internal semi-circumference of the ring, and then directs it obliquely inwards and downwards as for reaching the pubis by following the direction of the external pillar of the inguinal passage. In this manner the epigastric artery and the spermatic vessels are certainly avoided. Scarpa and the moderns add that it will be the same with respect to the obturator when it comes from the supra-pubic artery, since the incision follows in some measure the same course as the vessel; but to obtain this advantage it will not be necessary to act through Gimbernat's ligament at its middle, and still less to cut obliquely from below upwards, keeping close to the pubis as a considerable number of French surgeons understand and daily practise. Although it is preferable, yet what we have said above of the varieties sometimes presented by the epigastric and obturator vessels, proves that this method does not entirely secure us from hemorrhage. It would even render it very liable to occur, if the epigastric artery, or one of them, if there are two, should be found to the inner side of the neck of the sac, and also in case a large branch coming from the internal iliac or hypogastric vein should ascend also on the inside of the neck of the sac, as M. Manec has pointed out in his thesis, and which M. Meniere says that he has seen. In this case, incision upwards may be the most certain to prevent hemorrhage, especially if, as M. Manec directs, the bistoury be carried upwards and without the ring, in order to divide Poupart's ligament partially and perpendicularly to its axis. Some condemn the incision inwards as endangering the uterus and intestine in pregnant women, or the bladder when distended with urine. Hey, who quotes a case of the latter description, and who has never divided, nor seen divided, the epigastric artery, concludes therefrom, notwithstanding the remarks of Sir A. Cooper, that it is best to cut the ring upwards and outwards according to the practice of Sharp; but it is clear that a prudent surgeon will always avoid without difficulty the urinary reservoir and the gestatory organ, so that if the method of Gimbernat were attended with no other dangers the objections of the able surgeon of Leeds would be of little weight. The femoral circumflex artery coming by anomaly from the epigastric, or *vice versa*, so as to pass in front of the hernia, is the only one which cannot be avoided, unless discovered in laying bare the sac; happily the wound in it would be necessarily near the surface, and it would be easily seized and tied. On the whole, the most certain method of performing this incision without danger, is, in my opinion, to cut successively on several points of the sharp edge of the crural canal, as shown by Scarpa, M. Manche, and M. Dupuytren (unless the *septum crurale*, that is, the process of the *fascia propria* which closes the canal superiorly, have been transformed into a fibrous circle, the possibility of which is pointed out by M. J. Cloquet), and only to the extent of two or three lines for each division. The anatomical disposition of this passage, and the operations which I have already performed, induce me to believe that the stricture in this place is

always produced by the free edge of the falciform process, the concavity of Gimbernat's ligament or the neck of the sac, and scarcely ever by the superior ring; so that generally it should be sufficient to incise its inferior opening at one or more points to produce a proper relaxation, without carrying the bistoury into the abdomen. If this doctrine is not adopted, the incision should be made according to the principles of the surgeon of Madrid, or from below upwards, if we could cease to be tormented with the apprehension of wounding the spermatic cord.

A celotomy recently performed at La Charite, proves nevertheless that the incision inwards may be followed by hemorrhage. Arterial blood issued in great quantity from the wound. An assistant was obliged to carry his finger to the bottom of the ring, and compress from behind forwards. M. Boyer immediately had recourse to a little sac of linen carried even into the iliac fossa, which, being then filled with charpie, was substituted for the finger of the assistant. This apparatus was not removed before five days. Hemorrhage did not reappear, and the patient was completely restored. It would be difficult, I think, to tell what artery was here wounded. Was it the obturator coming from the epigastric? It would be necessary to admit that it had passed above the neck of the hernia. Was it the epigastric or an abnormal epigastric as in the case of M. Lauth? Might it not rather be the small branch naturally given off by the supra-pubic artery behind the symphisis, and which being more developed than usual, gave rise to this accident? On this subject it is perceived that there can only be suppositions.

The relation of the vessels with the neck of the sac will render the mistake so dangerous, if, as seen by Richter and A. Cooper, an inguinal hernia be taken for a crural hernia, and reciprocally, that the surgeon should never lose sight of it. A merocele pushed in front of the inguinal canal by old cicatrizes of the hollow of the thigh, as in the case reported by M. Boulu in the name of M. Marjolin, might easily give rise to error on this point; and incision outwards, as for bubonocele, would endanger the epigastric artery. M. Roux, who incises like Gimbernat, had occasion to esteem himself very fortunate in ascertaining by dissection, that the inguinal hernia, which he had taken for a crural hernia, was formed within the artery; that is, was direct or internal. If in a similar case, Pelletan had not discovered his error on arriving at the viscera, it is very probable that chance would not have served him so happily, and the epigastric artery would have run the greatest risk. Two other kinds of incision have been proposed by Else and A. Cooper for crural hernia. I have already said something of them in treating of hernia in general, and inguinal hernia in particular. In the first, the surgeon cuts the aponeurosis of the external oblique above, and in the direction of Poupart's ligament, removes the cord by pushing it inwards and upwards, penetrates as far as the peritoneum, passes a sound bent into a hook between the neck of the sac and the ring from behind forwards, or from the interior towards the exterior, and then cuts without fear and as freely as he desires. In the second also, the aponeurosis is to be cut and the cord removed, but the incision is made from the exterior towards the interior, although without opening the sac. These two processes which have been several times tested in the London hospitals, have too many disadvantages to be generally adopted, or for me to stop to describe or oppose them at greater length.

ARTICLE III.

Umbilical Hernia.

§ 1.—*Anatomical Remarks.*

With respect to hernias the umbilicus is presented in two very different conditions at different periods of life. Before birth it is a ring with but little resistance, giving passage at the same time to the three umbilical vessels and the prolongation of the bladder, called the urachus. As soon as the child is separated from its mother, the parts contained in this ring contract, solidify, and cease to fill it exactly; and it is thus that the intestines tend continually to escape during the first months of life. Later, the ring itself contracts, closes, is applied against the fibrous muscles formed by the relics of the vessels, so that in the end the whole presents under the aspect of a very dense inodular cicatrix; and in adults umbilical hernias are not made through the ring itself, as in infancy, but by penetrating the aponeurotic fibres some lines without its circumference. Seen from the interior of the abdomen, the umbilical region considered in man entirely developed, sometimes presents a prominence, and more frequently a slight tunnel-formed depression, upon which are spread in a radiated manner the suspensory ligament of the liver above, and the remains of the umbilical arteries with the urachus below. These four cords circumscribe their four triangles, whose points meet on the circumference of the mesogastric cicatrix. In the interval, the serous membrane, always easily recognized becomes more and more adherent as it approaches the centre, so that behind the ring it is entirely blended with the tissues which it lines. The *fascia propria* or the sub-peritoneal cellular tissue is for the same reason in very small quantity and very compact. The *fascia transversalis* does not extend so far. The *fascia superficialis* and the adipose cellular tissue, as well as the integuments themselves, have nothing in them remarkable, except that they reach like the corresponding tissues behind as far as the umbilical tubercle, with which they are also very intimately blended. With this arrangement, it is evident that the several points of the umbilical periphery do not offer the same resistance or the same solidity. On account of the vein being the last obliterated, of its being naturally softer and less voluminous, and nothing tending to draw it upwards, the umbilicus in general remains weaker, thinner, and more easily dilated or passed through in its superior half than inferiorly, where the three branches, arterial and vesical, are applied with force against each other, soon acquiring a solidity which closes it exactly in this direction. But when it is said that umbilical hernia in adults does not take place through the ring, some explanation is necessary. If the term exomphalos is reserved for that only which distends and pushes before it the cicatrix, making it in some measure disappear, it is true that it is only met with in infants, because in fact it is only possible while the several branches of the omphalo-placental cord have not yet become solid and transformed into a fibrous knot. But if it be umbilical hernia whenever an organ has escaped by the ring which was filled by the expanded vessels during the fœtal life, undoubtedly it is possible, and has been met with at every period of life. If

in this case the cicatrix is usually thrown to either side of the tumor and scarcely ever upon its centre, this arises from its being always a little less adherent on certain points of its circumference than on the rest. Scarpa relates however, that in one of his patients the sac was divided into several apartments, by the ligaments of the mesogastric muscles. Moreover, as in this place there is no circle nor canal naturally open, it is easy to see that hernia should be made almost as frequently through a fissure of the aponeurosis or linea alba as through the umbilicus itself; so that Monteggia, who was one of the first to say that hernias of this region happen without the ring, was only wrong in making that a constant occurrence which was merely a very frequent one. Be this as it may, the viscera in this place only pass through a simple ring. There is no umbilical canal, and it is almost unexampled for the arteries to have preserved their cavity until adult life. Haller, Boerhaave, and some others, contended that this is not the case with the vein, the permeability of which however is so rare that it should cause no apprehension in the operation. In the anomaly observed by M. Manec, the supernumerary epigastric vein issued through the umbilicus without losing its volume, and formed an irregular loop beneath the integuments, re-entered the abdomen through the same opening, and run into the horizontal fissure of the liver; while that published by M. Meniere ran directly beneath the liver without deviating towards the skin. It is evident therefore that the risk of cutting this vein is the greater as nothing can indicate beforehand in what direction it will be found. As the viscera escapes through a simple circular opening and not through a canal, umbilical hernia has not, as inguinal or crural hernia, any sheath, fibrous or serous, which may strangulate it at a variable distance from its root. The peritoneal layer which is there observed presents, not at all, or very incompletely, the characters by which it is known in the groin; and to exomphalos is strictly applicable what I have said of the absence of the sac when treating of the operation in general. It was this which Lassus said was deprived of it in a case in which it was surrounded with such thin coverings, that he opened the intestine which had passed through a rupture of the epiploon. The external face of the membrane is so closely united with the surrounding laminæ, that it is most frequently impossible to separate it from them. In reality, it is only the portion which originally line that point of the ring, which the organs have pushed before them in forming the hernia. Being enlarged by simple distention, as a cell of lamellated tissue which enlarges to form a cyst, and not by the progression or accompaniment of the abdominal peritoneum, it cannot, as in the groin, be distinguished from the other tissues. A peculiarity no less important in practice is, that it seldom contains any serosity, and therefore is almost constantly found in immediate contact with the viscera. I must say however that this law has been laid down in too absolute a manner. In a woman upon whom I operated some days since for a strangulated exomphalos, there was more than six ounces of reddish serosity in the hernial envelopes, and about three ounces came from another who was operated upon at Tours in 1818 by M. Piplet in my presence.

The organs which may be displaced to form umbilical hernia, in their order of frequency are the epiploon, the transverse colon, the small intestine, the stomach, the cœcum, the sigmoid flexure of the colon, the liver, the duodenum, and even the pancreas. These several parts are sometimes found in it in so

great a number, and forming so considerable a mass, their containing pouch becomes extremely thin, so as even to burst at last, as occurred to the patient mentioned by M. Boyer, whose death the operation could not prevent. More than once it has been seen, in the fœtus especially, entirely deprived of covering, or only covered with an exceeding thin membrane. Mery and Balzac have given cases of this kind. I observed one myself in 1819 at Tours in the practice of M. Mignot. It often happens, but not always, as some facts first induced me to believe, that the digestive tube is situated, at the beginning of embryo existence, in the root of the umbilical cord. But if the return of the intestines does not take place, or only partially occurs before the end of pregnancy, the child is born with exomphalos. The viscera in this case should be covered only by the thin tunics of the omphalo-placental cord. And we easily conceive how distension may rupture this feeble barrier, and leave the hernia completely bare. The same may also happen in the first hours or days after birth. In this respect therefore an essential difference is to be established between umbilical hernia of the fœtus, that of the first moments of external life, and that of adult age. In the first, the natural tunics of the cord form the sac and the envelopes; in the second, the cicatrix having had time to be formed, the organs in issuing must cover themselves with the peritoneum, the integuments, and the intermediate cellular tissue; the third, obliged to pass between the vessels or along side of the common knot that unites them, is moreover forced in the majority of cases to break through the interior of the ring or the environs of its circumference, to open itself a passage and become situate beneath the skin, distending by degrees the corresponding peritoneum Frequently too the hernia is affected at some distance from the umbilicus or in its periphery. As long as it is only one or two lines from that point, its texture and the relative disposition of its elements offer nothing peculiar; but if it is further removed, the sac and its cellular lining present other characteristics. The peritoneum is then more movable and less adherent, and allows itself to be carried along and displaced without difficulty; and an umbilical hernia of this description is often found furnished, with an evident sac. The *fascia propria*, having recovered a part of its laxity, and its thickness, allows the sac to be distinguished from the external tissues, and fat or serosity sometimes to accumulate in its parenchyma; and thus have fatty tumors or hernias been seen to manifest themselves around the umbilicus. M. Fardeau cites one which was prolonged into the interspace of the two laminæ of the suspensory ligament of the liver. M. Bigot, M Ollivier of Angiers, Beclard. and before them Heister, Petsch, Morgagni, Klinkosch, Pelletan, Scarpa, Mr. Lawrence, M. Crueilhier, and M. Berard, have met with others which had their root in the sub-peritoneal layer, and I recently dissected one which extended as far as the falsiform curve of the umbilical vein. It was probably above this cicatrix, and not through its interior, that the hernia mentioned by M. Cloquet escaped, which had pushed before it the hepatic ligament and used it as a sac.

§ 2. *Operation.*

The operation for umbilical hernia is considered very dangerous, and appears in fact to be more so than that for inguinal or crural hernia. This depends

perhaps on the proximity of the stomach or diaphragm on the organs contained in the tumor having more immediate relations with the principal viscus of digestion, or perhaps on the too advanced stage of the disease, when the operation is usually decided upon. But before looking for the causes, it would be better to establish the fact itself, and be positively assured that the operation is actually more dangerous at the umbilicus than elsewhere. If the tumor is of middling size, a simple incision parallel with the linea alba, is sufficient to lay it bare. In the contrary case, Scarpa to the contrary notwithstanding, there is no objection to the T incision, or even the crucial. This incision is to extend at both extremities a little beyond the tumor. In this place the integuments are in general too tense to allow of the precaution of a fold before dividing them. They are then cut from without inwards as if for laying bare an artery. The subjacent layers are to be cut in the same manner; that is, passing the bistoury over them with all possible lightness. The sac not being separable is hard to be discovered, if we persist in cutting layer by layer with strokes on a determined point the parts which separate it from the skin. But as it is often very near the cutaneous envelope, and usually contains but very little serosity, too much caution cannot be used in seeking it. From the moment the bottom of the incision seems to be formed but by a very thin lamella, the instrument must be handled more lightly than before; and when the membrane just divided is found to be separated from the parts it covers by the least interspace, a director is to be carried beneath it, for we have probably arrived at the sac. There will be no further doubt on the subject, if any fluid escapes, or if, as is frequently observed, some fatty lumps protrude through the opening. Having arrived within the hernial pouch, the bistoury conducted by the under finger, if the probe pointed bistoury is used, otherwise by the grooved director, immediately enlarges the first orifice and opens largely all the coverings of the tumor. In umbilical hernia, particularly, the epiploon is apt to be found forming there sometimes a considerable mass. We must not however be deceived by appearances. Beneath it is almost always found a portion of intestine, which it covers, forming in some degree a second sac. For this reason has been seen here more frequently than elsewhere the intestinal procidentia rupturing its epiploic covering, passing through it, becoming strangulated in the ring thus made, and placing itself in immediate contact with the real sac, presenting in a word under the edge of the bistoury the moment that has penetrated into the interior of the hernia.

After opening the sac, the first thing to be done is to ascertain the arrangement of the displaced organs. Consequently some point of the epiploon which is not adherent is sought with the finger, lifted up, unfolded, and extended on one edge of the wound. The intestine is then seen beneath, if it be in the tumor at all. In cases where this simple derangement of the parts will suffice to allow its reduction, this should be effected immediately. Hey, and almost every operator since him, have insisted strongly on the reduction being commenced with the intestine, and not with the epiploon as recommended by Pott. The intestinal portion having come out last, being situated more deeply, and in general easier pushed back, is most conveniently reduced first. However, if an opposite disposition is met with, and the omentum has more tendency to return than the intestine, I do not see why we should persist in following the rule laid down by Hey. When the intes-

tine is gangerous, and this should rarely be the case, since, as is well known mortification is infinitely slower in manifesting itself in hernias of the large intestine in entero-epiploceles, and especially in hernias purely epiploic than in enterocele, it must be recollected that stercoral fistulæ or preternatural ani at the umbilicus are seldom cured. This arises, as Scarpa has clearly established, from there being no membranous funnel formed at the expense of the sac behind the umbilical circle. How could it be formed in fact, since the serous surface of the pouch is intimately adherent to it, is formed there, developed at once, and not borrowed from the internal peritoneum as in inguinal or crural hernia? Gangrene, or a perforation of the intestine, seems therefore to require that invagination or the suture be resorted to immediately, and that we should not attempt the establishment of an abnormal anus. I would say, however, that in the operation performed by M. Pipelet, which I have mentioned above, a gangrenous eschar of the intestine was removed, and a fistula established, which being left to itself ultimately closed and cicatrized completely. It was also in a case of umbilical hernia that M. Chemery Have performed invagination with success, and the singular operation reported by Scarpa, who took it from the old Journal de Medicine.

The incision, when necessary, is so easily performed and attended with so little danger that it is seldom dispensed with. It may be done on almost any point indifferently. Strictly speaking, it may be possible to touch the liver, to wound the umbilical vein or arteries, and even the urachus; but to happen it must almost be done on purpose, unless in case of anomalies which are too rare to be reckoned among the dangers. We must not, however, forget the abnormal veins described by MM. Manec and Meniere. Although it is not sensibly more advantageous to incise the umbilical ring downwards than in any other direction, I see no inconvenience in following the advice of authors who recommend for greater safety to direct it upwards and to the left. By incising largely, the risk of weakening too much the parietes of the abdomen, and exposing the patient to an almost certain relapse, will be easily avoided it seems to me, if, instead of making a single incision of half an inch in depth, three or four are made of one or two lines only on different points, as in the patient upon whom I operated with M. Gresely; if, in a word, the "debridement multiple" be adopted in umbilical hernia as in those which have been treated of heretofore. Although there is no such thing in exomphalos as strangulation by the neck of the sac, and although the ring producing the stricture is generally round, prudence does not the less dictate to see, before proceeding to the reduction, in what condition is the strangulated portion of intestine. If we operate without laying bare the whole of the tumor, after the method of Franco, Rousset, or Pigray, it must be recollected that the ring is seldom distinct from the sac, and unless we combine as directed by M. Raphel, the process of Bell with this method, we shall not succeed in removing the strangulation without at the same time penetrating the interior of the sac. This mode of acting is still less proper for the umbilicus than elsewhere, although Scarpa recommends it with a kind of complaisance, and Sir A. Cooper had recourse to it twice with success in similar cases. Immediate union may be attempted with more advantage and facility after umbilical celotomy than in the after treatment of hernias of the groin. The whole pouch, formed in some measure of a single layer, has a much less tendency

to roll upon itself, and a much greater to reapply itself to the points it originally occupied. I cannot advise it, however, because in my opinion the operation renders the radical cure so much the more probable as the wound is cicatrized in a manner more completely mediate. For the rest, this is the part of the body where the organs have the most need of being sustained by moderate compression, after being returned into the abdomen, and this, no doubt, because the opening which afforded them passage, is usually very large, and because especially it forms a ring, a complete circle, which passes directly through the abdominal wall.

Art. 4.—*Ventral Hernias.*

Hernias in the linea alba, whether above or below the umbilicus, differ too little from those we have just examined to require a special description. If they happen to become strangulated, which is almost unheard of, their operation will have nothing in it peculiar. The same must be said of the hernia of the flank or loin, described by J. L. Petit, observed once at Mont Rouge by MM. Cloquet and Cayol in a man seventy-five years old, on another occasion by Lassus in a subject who had one on each side; since then by Pelletan in a woman who had the belly simultaneously studded with hernial protrusions. Ventral hernias, properly so called, that is, those which are formed without the linea alba, umbilicus, and other natural openings in the abdomen, either from a simple fissure in the aponeurosis or muscles, or in consequence of a cicatrized wound of the parts, as Schmucker, Desault, Lassus, Richerand, Anderson, and a host of others have observed, are scarcely ever strangulated; or if strangulation does take place it is almost constantly possible to reduce them by the taxis, by position, and other resources pointed out in the preceding articles. It is seen nevertheless in the English journals of late years that neither Mr. Key nor Mr. Bransley Cooper could reduce a strangulated ventral hernia until after subjecting it to an operation and cutting the stricture, when the patient was happily restored. Supposing all these species of tumors to require celotomy, we should act as in cases of umbilical hernia, and they will require no other cure than the course of the epigastric, lumbar, or anterior iliac may demand.

Obturator hernia, of which examples are given by Arnault, father and son, Duverney, Garengeot, Verdier, Pipelet, and Eschenbach; since observed by A. Cooper, H. Cloquet, Hesselbach, and Marechal, and which seem to be sometimes susceptible of strangulation, would be a little more embarrassing. The opening which affords it passage being then transformed into a kind of canal, the pelvic orifice of which is formed by the pubis outwards and upwards, and by the obturator membrane in the rest of its extent, is limited by the thickness of the obturator muscles. In this case, the viscera are surrounded by the pectineus anteriorly, the adductor magnus posteriorly, and the adductor brevis and longus interiorly and superiorly. Being obliged to pass through these several muscles, or to separate them to become evident at the internal and inferior extremity of the hollow of the groin, obturator hernia does not appear susceptible of being strangulated but at its entrance into the obturator canal, as really occurred in the cases of it which have been reported. It seems that the sub-pubic artery being always found on its external side,

either above, below, or directly without, the incision must be made on its internal semi-circumference. I know that this operation was first attempted by Garengeot on one of his patients, *rue du Sepulcre*, and more recently by a German surgeon in a very similar case; but when we think of the parts to be passed through to arrive at the seat of strangulation, of the depth of the obturator membrane, and of the difficulty of discerning the place occupied by the vessels, and that the bladder or vagina may be touched, it is quite allowable not to recommend it. Ischiatic, perineal, vulvary, and vaginal hernias also enter entirely into the domain of surgical pathology, and have no other relation with operative surgery than inasmuch as the taxis, position, and retaining bandages methodically applied, form their principal remedy.

CHAPTER IV.

SEXUAL ORGANS.

The genital system of either sex calls so often for the assistance of operative surgery, that it alone could furnish the surgeon matter for many volumes. I must be permitted to say a few words, in anticipation, upon some of the least familiar of its diseases.

Vegetations.—In 1825, I was conducted by Mme. Delon, a midwife, to the house of a lady, aged about 30 years, and who for some months preceding had had a pyriforme tumor, red, and of but little consistency, about the size of a nut, the lower extremity of which was swelled or rounded and slightly projecting, attached by its root to the urethra, at a depth of 4 lines. I seized it with a curved hook, drew it a little towards me, and excised it on the spot without giving the least pain to the patient, who was well on the next day. In 1829 I met with a case precisely similar. By a reference to the Lancet it will be seen that Mr. Wardrop has noticed three others. Similar vegetations have been mentioned as occurring in females by Vogel, Rosenmuller, Chaussier; and every thing leads to the belief that excision is the true remedy for this affection.

It appears that men are equally liable to them. I know of two instances. In one, the excrescences, three in number, scarce equalled in size the bulk of a grain of barley. In the case of the second patient, a young Englishman, who was pointed out to me by Mr. Beaumont, a student of medicine, there were likewise several, but they were still smaller. They were similarly inserted behind the meatus urinarius. None of them reappeared after being injured or excised. Are not the polypi of the urethra, about which M. Nicod has for several years entertained the public, and about which he has again published an essay, of this genus of production?

SECTION I.

Sexual organs of the Male.

Art. 1.—*The Scrotum.*

§ 1. *Anatomical Observations.*

As I remarked when speaking of inguinal hernia, it is almost always easy, with a little attention, to distinguish six or seven concentric tunics, or coats in the scrotum; 1st, the skin; 2d, the subcutaneous layer, which covers at once the two testicles; 3d, the deep lamella of the cellular layer, which, enveloping the whole extent of the cord and of the testicle, come together to constitute the dartos and the septum, in such a manner as to separate the two seminal glands from each other. Beneath these three first layers, which may

be called the *general*, we have presented to us the inferior or *special* sheaths, 1st, that which is continuous with the circumference of the abdominal ring; 2d, the cremaster muscle, which immediately after it envelopes the testicle *completely*, and goes down to the bottom of the scrotum of the corresponding side; 3d, the fascia transversalis, which constitutes what is properly called the sheath of the cord, which sheath contains within it the fascia propria, the cellular tissue, and the spermatic nerves and vessel, with the vas deferens, and which ceases at the adherent margin of the seminal gland. We have already seen that but few vessels are distributed to these numerous layers; they are, externally, the same branches of the scrotal or external pudic arteries, placed transversely or obliquely between the cremaster muscle and fascia transversalis;—the inguinal branch given off by the epigastric and the spermatic artery enclosed in the sheath of the ring. In the centre of all these coats, there exists yet another called elytroid or vaginal, which separates them from the testicle. It is a small sac adherent on its external surface, soft, smooth, bedewed with serosity without, and which may be divided in the mind into two portions, as the pleura is; the one portion parietal, spreading over the inner surface of the external coverings, the other portion visceral, which invests the testis as far as its adherent margin, at which the two sides of this layer form by their approximation a septum, before they spread out to become continuous with the parietal layer. Superiorly the elytroid tunic is prolonged into the inguinal canal, crossing it to become blended with the peritoneum, of which it is but an appendage.

In fact, previous to birth there is no serous coat in the scrotum, which at that period is composed in reality only of integuments and subcutaneous layer or fascia superficialis. It is indispensable that he who would form an accurate idea of what is observed in later years should recollect this disposition of parts. The testicle, which during fœtal existence was hidden underneath the kidney, or below the Fallopian ligament, drags with it the peritoneal coat by which it was covered in the abdomen, and to which it adhered intimately only at its posterior margin, and when it makes its appearance externally turns it over upon itself. As it continues its descent, the testicle carries before it both the fascia transversalis, the small oblique muscle, and the fibro cellular division of the obliquus externus. These all press upon the three primitive tunics of the scrotum; but, inasmuch as the deeper of these three latter had previously contracted adhesions to the inferior surface of the penis, a septum consequently results which is soon much increased in thickness by the correspondent sides of the distinct pouches which have descended from the abdomen. The portion of peritoneal prolongation, which is contained in the inguinal canal, and which embraced the side of the cord in its upper portion, confined within a contracted space, and having no longer any functions to perform, is speedily closed and obliterated, and even so blended with the surrounded tissues, as that in adult age no other vestiges of it are discoverable save the funnel-shaped depression observed at the visceral opening of the track of the testicle, so that the exterior serous pouch is then completed, occluded, or made to terminate in a cul-de-sac both above and below. Certain writers have been of Hunter's opinion, and it is one which even at this day is pretty generally acceded to, that the exterior layer, now known as the fascia superficialis enters the belly through

the inguinal ring to be attached to the adherent margin of the testicle: that the prolongation, called gubernaculum testis by the English surgeons, forms by its extension the dartos and the septum; in a word, that its function is to draw down the glands to the bottom of the scrotum. M. Blandin has thought that he perceived, in the natural enlargement of the parietes of the abdomen after birth, the explanation of the descent of the seminal glands, and of the imaginary expansion of the gubernaculum testis. But M. Manec has noticed, and I verify his observation by my own, in the case of an adult whose testis was still within the abdomen, that the fascia superficialis passes before the abdominal ring, in the external oblique muscle, and does not penetrate into it. I may add, that this ring is then separated from the external tissues, by the very external layers which are to be extended at a later period around the cord, to form its fibrous tunic, and that the idea of Hunter seems to me wholly without foundation.

§ 2. *Hydrocele.*

It frequently happens that serum accumulates or spreads between the different layers of the scrotum. If it be betwixt the integuments and cellular tissue, or between the cellular tissue and the prolonged aponeurosis of the external oblique, the hydrocele will evidently be *diffuse*—will rarely remain limited to one pouch of the scrotum only. If on the contrary the fluid passes between the fibrous tunic and the cremaster, or between the cremaster, the fascia transversalis, or even the fascia propria, the hydrocele, although owing to infiltration, may nevertheless be arrested at one of the halves of the scrotum. It is doubtless owing to their puncturing to this depth, that young men, who with the hope of avoiding military service, endeavor to simulate inguinal hernia by inflating the testicular tunics with air, succeed occasionally in deceiving professional persons. If the infiltration occurs in the tissue of the cord, that is to say between the lamellæ which connect its vessels and its excretory duct, we may still have a diffused hydrocele, but one which is limited by the thickness of the cord without entering the scrotum. When, instead of its being disseminated in a number of distinct meshes, the serum is deposited in one or several particular sacs, that form of the affection results which is called *hydrocele from effusion.* Whenever the effusion is carried on in one or other of the places just indicated, viz: between the tunics of the scrotum or in the thickness of the cord, it takes the name of *encysted hydrocele.* This latter species is most often seen around the spermatic vessels and duct, for the simple reason that the areolar tissue is here particularly encountered. The name of encysted hydroceles, which has been given by many to those serous accumulations which are seen to occur in the thickness of the epididymis of the testis itself, or between that fibrous tunic called the *albuginea* and the serous layer which covers it, might perhaps in strictness be retained with propriety. But as these are real diseases of the prolific organ, more than one inconvenience would result from their conjunction with hydrocele properly so called.

The vaginal tunic, being the only one naturally free, and exhaling continually an aqueous vapor, is that which is most often the seat of the effusion in question; so much so, indeed, that the word hydrocele, unaccompanied by

any other epithet, is employed only to designate this particular variety. The parts composing the scrotum in which a hydrocele of the tunica vaginalis has for a long time existed undergo at times numerous changes. Dr. Mott has met with a scrotum in which an envelope existed, formed almost entirely of small calculi or stony projections. An osseous degeneration of the same tissue, has been recorded by Wagner, Beclard, M. Cloquet and M. Yvan; at other times the degeneration observed resembles cartilage, or is of a lardaceous nature, which may increase in hardness and thickness, and form at length a truly hard and tough shell. The internal surface has been found villous, knobbed, tuberculous, or covered with fungous growths. The liquid enclosed in these cases is far from being always limpid or of a lemon color. It is in certain cases reddish, or deep brown more or less dark, resembling chocolate; again it is of a decided yellow, and much more thick in consistence than is usual. Beclard and M. Cloquet have remarked in it small crystals of a micaceous, greasy, or chalky material. MM. Murat and Baillie have noticed therein, small, smooth, floating cartilages, and it is even said real calculi; sometimes, also, a viscous, stringy substance, whose presence was generally coincident with extensive disorganization of the lining membrane. The serous expansion of the scrotum may offer or encounter more resistance in one way than in another. In this case it happens sometimes that its dilatation is unequal; so that the tumor carries the testicle before it, even to its external surface, spreading out the cord, either as Scarpa thinks by effecting its decomposition, or in giving it a riband-like appearance, instead of leaving it within which is asserted by M. Dupuytren. It is owing to this unequal dilatation, that a hydrocele often presents inequalities on the exterior, or is divided into two or more portions, having the form of a double bag.

It is to be observed, however, that to separations in the fascia propria, or the cellulo-fibrous tissue which immediately surrounds the tunica vaginalis, similar protuberances are owing.

Operation.—Hydrocele from infiltration requires no instrumental aid, unless it be decided, after a fruitless exhibition of appropriate topical applications, to treat it by slight punctures or scarifications, or by two deep incisions made on either side of the median line on its inferior surface, which are still advised by Sabatier, and which formerly were in such high estimation.

In a hydrocele from effusion, whether one in which the fluid occupies the tunica vaginalis, or be contained in several cysts, it appears to be now generally admitted that the patient is never relieved either by local topical, applications, or general treatment. It would be incorrect, however, to receive this assertion in too unlimited an extent. It is certain, on the contrary, that hydrocele of the tunica vaginalis itself even has disappeared under the agency of certain cataplasms, lotions, and other topical measures. The thesis of M. Lesuer, for instance, shows that in the Hotel Dieu of Paris, leeches and revulsives have triumphed frequently over the disease. By the work of M. Sabatier, again, it will be seen that M. Dupuytren has cured many by means of blistering the tumor, and M. Manoury and many other practitioners have cited numerous facts in support of the practice. On the authority of M. Bertrand, moxa in the hands of others has not been less efficacious. M. Græfe of Berlin has recently revived the boasted prescription of Keate in 1788, consisting of a solution of the mur. ammon. in alcohol

or the acetate of squills. I have myself twice seen a hydrocele removed by the use of such astringent cataplasms as are advised by M. Brodie, and by frictions with the mercurial ointment; but these exceptionable instances of success are very rare, and met with only in long standing cases, in which the hydrocele was small, or could be traced either to a traumatic lesion or to an irritation whose principle it was possible to discover. In the two cases which I saw effected the disease was but of two months existence, and originated in a blenorrhagic swelling of the testicle. Latterly, blisters, the muriate of ammonia in aqueous solution, afterwards red wine, and the most powerful astringents were vainly employed in two of my patients, in whom nevertheless the hydrocele had existed but six weeks, and was owing to a bruise of the testicle; leeches and emollients had been previously applied, but with a similar want of success; the operation, however, was very readily triumphant. Spontaneous cures are occasionally met with in hydrocele. Bertrand and Sabatier have seen it following violent straining in coughing or micturition. Loder speaks of a patient in whom the kick of a horse had a similar result. The tunica vaginalis is ruptured, infiltration of the scrotum and penis follows, the effused fluid is speedily absorbed, and the hydrocele disappears finally, or for a few months only, as in the case recorded by M. Boyer. Two new occurrences of this nature have been published in La Lancette by M. Serre of Montpelier. A third is contained in an essay by M. Bertrand. I have also learned from M. Double, a house pupil, that in a patient under the care of M. Roux, at la Charite, no vestige whatever of the disease remained on the day on which it was to have been operated upon. Notwithstanding all this, the operation when preferred is so simple, and its effect so uniform, that, even supposing we could by the aid of topical applications succeed in curing a certain number of cases of hydrocele, it would still deserve to be uniformly put in practice. The steps in its performance have singularly varied since the days of Celsus.

Incisions into the tumor, the excision of a portion of the sac, scarifications on its internal surface, cauterization by the red hot iron, or caustics, the use of tents, pledgets of lint, canulæ, setons, and of various injections, all have been so highly lauded, as to constitute numerous plans of practice, the greater part of which modern surgery has now discarded.

Cauterization, as described by Ætius after Leonides, was in use very long before the time of Guy de Chauliac, to whom Sabatier seems disposed to award its employment. By some it was effected by establishing an eschar on the inferior part, by others on the superior part of the tumor, which eschar was renewed until it reached the fluid. Certain other operators preferred to effect the object by means of heated metal, or by that L shaped cautery spoken of by Paulus Æginetus. The practice, which has a thousand times been revived, has been particularly commended by Else in England, Dusaussoy in France, and by Eilrich in Germany. The second of these writers imagines that the effect of the escharotic is not merely to produce sphacelus of the scrotal tunics, but that it induces simultaneously a gangrenous inflammation of the whole tunica vaginalis, which is seen to fall away in flakes after the separation of the eschar. Humpage had conceived a method of creating it by placing some of the spirit of salt (an aqueous solution of hydrochloric acid) around a circular plaster, which was to serve as a protection to

the tissues in the vicinity of the cauterized circle. Be this as it may, it is, under whatever form it be executed, a treatment which ought to be definitively proscribed.

I should think quite as unfavorably of the tents of the canulas, which are much less dangerous and barbarous, were it, not that some highly distinguished practitioners of our day continue to advocate their employment. The use of these measures, so far from being original with Franco, Fabricius ab Aquapendente, or with Moimiches, as Sabatier and M. Boyer would lead us to suppose, goes back, in fact, at least to the time of G. de Salicet, who in speaking of hydrocele makes use of these words: "Let the scrotum be punctured with a lancet, and the water drawn off, and then let *a tent* be placed in the aperture, so that when you will you may freely draw off that which is within the enlargement."

Instead of a proceeding so simply, F. de Hildus has proposed to place a ligature round the tunica vaginalis, incise it and to leave there a pledget of lint; which proceeding Bell has copied under this latter point of view. Monro recommended that the serous tunic of the testicle should be irritated with the point of a trocar; Larrey, that one of gumelastic should be allowed to remain within it for several days. If it be incontestibly true that the use of these measures is attended with a certain ratio of success, it is not the less true that suppuration in, and not simple adhesion between the surfaces often results from them; and that they are not so constantly successful as to bear any comparison with the methods at present resorted to. The same is to be said of setons, about which M. Sabatier has found no mention made by the ancients, which Sprengel refers to Lanfranc, and M. Cooper attributes to Franco, although it was in all probability alluded to by Galen, when he says that we must draw off the water from the scrotum either with a syringe or by means of *a seaton.*

It is, besides, at the instance of the phycisian of Pergamus, that Guy de Chauliac advises us to seize the scrotum with flat forceps, having an opening at their extremity, so as to permit the passage through them of a long heated needle, to the eye of which is attached the seton which is to be left in the wounds until the water is evacuated. It would appear moreover, as has been remarked by Le Clerc, that C. Aurelianus had intended to indicate it. Peyrilhe also thought that he discovered in the works of Paulus Ægineta a reference to the same idea. Notwithstanding this method received, until towards the end of the seventeenth century, the commendation of all authors, it was nearly wholly abandoned when Pott, sixty years ago, undertook to re-establish it. The method of proceeding which he adopted, and which has since been modified by Roe of Edinburgh, needs not here to be brought forward, and the less so that it is not probable that setons will henceforth be employed by any one. Should it however be thought fit to return to its use, its name alone serves to explain it; and it needs but to be remembered that a long pledget of cotton, or any other material, or a thin riband, is to be passed through the swelling, that all may understand the mode of conducting a similar operation. There now remains for comment, incision, excision, and injections.

1st. *Of Incision.*—This operation, which since the time of Celsus, of Paulus Ægineta, of the Arabians, of Guy de Chauliac, has been practised in every

age, is performed with a strait or convex bistoury. The patient is placed on his back, and his limbs moderately flexed. The surgeon grasps the posterior surface of the scrotum with his left hand, and thus makes tense the tumor. With the right hand he makes an incision on its interior face in the upper part from without inwards, if the convex bistoury be employed; and by puncturing, if he makes use of the straight bladed instrument, The opening ought to be large enough to admit the finger, or if by accident the incision be too small to permit this, a director must take its place. A button, or probe-pointed bistoury serves to complete the division of all the anterior portion of the cyst, proceeding with the incision from within outwards, and from above downwards. As the object is to produce adhesion between the two layers of the tunica vaginalis by exciting suppurative inflammation, the wound is to be filled with lint and dressed daily, that it may fill up only from below towards the edges. By these means a very permanent cure is generally effected; only it sometimes happens that small spots in the membrane escape the irritation, and by giving rise afterwards to small cysts, permit a partial reproduction of the disease. In France at least, since we possess methods so much more simple, the pain and risk which attend it sometimes, and the length of the treatment, have caused it to be generally rejected; so that, notwithstanding the reasoning of M. Rust and M. Gama, who still give it the preference, it seems proper to consider it only as an occasional resource: as, for example, in case of encysted hydrocele, of multilocular hydrocele, and of hydrocele complicated with extensive lesion of the tunica vaginalis or of the testicle itself.

2d. *Excision.*—It would appear that excision also has been practised since the time of Leonides. We read in ancient authors, and in Paulus Æginetus amongst others, that after having laid open the tumor, some of them were in the habit of seizing the lips of the tunica vaginalis, and rolling it within upon hooks in order to tear it away. It is to Douglas, however, that the merit of directing to this method the attention of surgeons in the last century, and the important rank which it still holds amongst us, is due. Imbert de Lonny, by combining it with the use of tents, thought that he had instituted a new practice, which has not been adopted. It may be done in various ways. It was the practice of the English surgeon, to begin by circumscribing within two semilunar incisions, an elliptical portion of the integuments on the fore part of the scrotum. This portion he removed, opened into the tunica vaginalis, which he afterwards gradually dissected until near the adhesions to the testicle, so as immediately to excise both sides by the assistance of good scissors. M. Boyer advises a simple incision the whole length of the hydrocele, then that we should dissect the tunica vaginalis as far away as possible from the side of the seminal gland before we give exit to the liquid within, and then to open the cyst and cut away a portion. Lastly, it has been found more simple by M. Dupuytren, to grasp the whole tumor below with the left hand, so as to project the anterior wall as much as possible, to make the incision either on the plan of Douglas or Boyer, as it appeared to him adviseable or not to remove a portion of the integuments; then to isolate as it were the tunica vaginalis by pressing it from behind forewards treating it, in a word, almost as one drives a kernel from its fruit by pressure with the fingers. This done he opens into the cyst and excises it as we have before mentioned. The wound is immediately filled with dry lint after either method of operating, and the dressing is the same as after

simple incision. From this detail, it will be seen that the operation by excision is a painful one, and necessarily a longer one than the others. It has the advantage of preventing all return of the disorder, since it irrecoverably destroys the membrane in which it takes place. Still as it is almost impossible to take away the whole tunic, it does not appear how it should place the patient irrecoverably beyond the possibility of a relapse. It has been besides observed, by M. Boyer, that hydrocele returns sometimes after excision as well as after incision; and the method, at least as a generally applicable one, is to be proscribed. It is applicable only in those rare cases in which the vaginal tunic is hardened, has degenerated into a cartilaginous or fibro cartilaginous state is studded within or without with bony or calcareous spots; considerably thickened when it forms a hard and solid shell; or when for some reason we have grounds for suspecting that the internal surface is not likely to take on adhesive inflammation; or when lastly, it exists as a foreign body in the scrotum which it is necessary to remove.

3d. *Injection.*—Most modern authors, proceeding on the assertion of A. Monro, attribute to an army surgeon of the same name as that author, the employment of injections in the radical cure of hydrocele. They had however been proposed, and the proposal acted upon long before. Celsus tells us that where the water is in a pouch, we must after evacuating it inject with solutions of nitre or saltpetre. Lembert of Marseilles, in his commentaries and observations published in 1677, distinctly says that the best method to be followed in the cure of hydrocele, consists in evacuating the water through a canula, so that the cyst may be inflamed by an injection, *through the same canula*, of the aqua phagedenica. With so much confidence had his trials inspired him in this species of medication, that he declares his intention to use no other. The praises lavished upon this process, first by Monro, then by Sharp and Earle, having been invalidated by the failures of many other surgeons, it did not take in England, and indeed has been only of general adoption within thirty years past in France. As it is now almost the only one practised, I shall dwell upon it in an especial manner, and give a more detailed account of this than any of the other methods.

The inutility of the precautions laid down by Benjamin Bell, who instead of the ordinary one, advises the use of a flat trochar, and recommends that previous to making the puncture the skin and the teguments subjacent be divided with a lancet. Being now universally acknowledged, I shall neither stop to discuss them nor the directions of Scacchi, who has highly vaunted the excellence of an elastic canula surmounted by a cutting extremity, in as much as the trochar, commonly called the hydrocele trochar, with or without teeth on one surface of the sheath, is considered amply sufficient for all cases. If however no variations are now made in the best instrument for puncturing the cyst and withdrawing the fluid, the case is nowise the same as to the irritating agent to be employed for the injection. The ancients, as we have seen, had recourse to solutions of more or less acridity. Lembert employed lime water containing corrosive sublimate. The surgeon of whom Monro speaks employed alchohol, either pure or diluted with water. During the same period red wine was tried. Earle has much recommended port wine weakened with a decoction of rose leaves, while Juncker, of Berlin, approved of medoc and water, and many others were content with solutions of the caustic potash,

MM. Boyer, Richerand, Dupuytren, and Roux, have permanently decided on the use of red wine, either simple or mixed with a little brandy or alcohol, in which the leaves of the Provins roses had been boiled. I have seen used by M. Jules Cloquet, and have myself employed, camphorated alcohol in one case, and in others brandy, pure or camphorated, to effect the same result. Some physicians at Angers, as it appears, have employed injections of nothing but cold water. Beclard, has cited some cases which were attended with success by these means, and M. Cuvellier in his thesis, has related a greater number still. In one case related by Schreger air alone was not less successful. It is easy, when we reflect on the object to be accomplished, to conceive that any of the above methods are in themselves of such a nature as to bring about the desired end. All that is necessary is to irritate the tunica vaginalis, and excite in its interior an adhesive inflammation, Now to produce such a result, cold water, wines of all kind, brandy, caustic solutions, in short any liquid whatever, as well as the beak of a canula, of a tent, the presence of a foreign body be it what it may, are evidently proper. The thing is to know what best succeeds, and creates at the same time the fewest inconveniences. Experience having decided in favor of red wine enlivened with a little alcohol in which roses have been boiled, I do not see why we need go on to make trial of others. I must remark however, that alcohol, which many have rejected from a belief that it was of two irritating a nature, and capable of causing dangerous inflammation, produces effects no more alarming than those of common wine, and that if I do not myself use it, it is because I have seen it fail of effect three times in eleven cases upon which I operated; whilst wine, which was used exclusively by M. Gouraud whilst I was at the hospital of Tours, and which is employed by M. Richerand at the hospital St. Louis, and at the Hopital de Perfectionnement by MM. Bougon and Roux, and which I have myself used in about sixty cases of which I have an account, has failed five times only.

The Operation.—Preparations. Before the scrotum is evacuated a syringe must be at hand capable of holding about two pints, and in perfect order. A quart or two of liquid, placed as has just been said, and a chafing dish of live coals to heat it, should be likewise ready; several basins are likewise necessary, either to contain the wine for the injections or to receive the fluid of the hydrocele. When all the preparations are thus completed, the patient is to be placed upon a table protected by cloths, or on the bed, and the surgeon supports the scrotum, as in the operation of excision or incision; assures himself anew that it is really a hydrocele before him, and not any other disease; and that the testicle, and the different components of the cord, are in such and such a state, and in no other. To be certain on this point, he suddenly raises the scrotum, places the cubital edge of one hand perpendicularly on its anterior surface, so as to intercept the light of a candle held on the opposite side, in such a manner as that the rays of light must pass through the serous cyst to reach his eye. The natural transparency of the fluid contained within the cyst, then enables him, when perfect, to detect the precise location of the testicle, and even of the spermatic cord. If any doubt still remains, it is proper to employ the little instrument invented by M. Segalas for seeing into the bladder, or a tube of wood or gum-elastic, a foot in length and several lines in diameter will answer the purpose.

The operator then takes the trocar, fitted with its canula, in his right hand, and plunges it at one blow into the centre of the liquid on the anterior, lower, and exterior surface of the tumor. To this precise spot a preference should be given, because, in the natural state the testicle and its dependencies are situated within, below, and behind; and because it is the best mode of hitting the middle of the tunica vaginalis. It is useless to say, that if before commencing the operation we could have been aware of the different distribution of parts, the instrument should have been introduced in another direction at a more suitable spot. The want of resistance, the escape oftentimes of a drop of the fluid between the canula and the wound and the depth to which we have arrived, are sufficiently indicative of the trocar having entered the cyst. The surgeon then takes hold of the tube with the index and middle fingers of the left hand, near the skin, and on the instant withdraws the canula sufficiently far to allow the liquid freely to flow out. When the sac is in some measure empty, he presses upon it in all directions, taking care that the point of canula follows the retraction of the part, lest it should become fixed between the other enveloping tunics. Up to this point the beak of the instrument must not be pressed against the morbid cavity in such a way as to interfere with the exit of the fluid.

An assistant now fills the instrument with the injection, which is to be at a temperature of about 32° *cent.*; more if the tissues in the individual seem indolent, or if the liquid itself be not of a very stimulant nature; a little less if the circumstances of the case are reverse; so warm, in short, as that the hand may be able to endure the heat though with slight inconvenience. The syphon of the syringe is now to be introduced into the external opening in the canula, to which it ought to have been previously fitted to be sure of its accurate adaptation. The assistant then slowly pushes down the handle until the syringe is emptied. The operator, holding the canula at its root, prevents it from moving within the sac or from withdrawing into the thickness of the scrotum, whilst as the assistant removes the syringe he applies the index finger to the orifice, and thus prevents the escape of the liquid. A second and a third fresh supply of the injections are forthwith similarly introduced, if necessary to enlarge the tumor to the dimensions it possesses before the operation. It is retained each time for about two minutes in the tunica vaginalis by some, by others for five, and there are again others who prefer its continuance for even six or seven.

There are some who recommend that the tunica vaginalis be filled a third time before it is finally emptied. It is prudent to press out from it the few remaining drops of the liquid, and even the air which may have obtained admittance before the canula is withdrawn. It is customary in the after treatment, to surround the scrotun with compresses steeped in the same wine as that injected, which are to be renewed thrice in the twenty-four hours, until the fifth or sixth day; that is, until the inflammation has attained the desired acuteness, when they may be replaced by emollient poultices. In some individuals the inflammation is at its height on the morning after the operation; in others it is not reached before the fourth, fifth, and even the sixth day. In one patient upon whom I operated in November last, no swelling or pain supervened during the two following weeks. Symptoms of inflammation appeared only about the tenth or twelfth day, although the person was young,

easily excitable, and of a nervous, rather than a lymphatic temperament. He had suffered the operation on the other side the year before, but with no greater inconvenience. In both instances the success was complete. When this happens the tumor is hot, red, painful, and resumes nearly its original size. A febrile movement, or even a pretty severe attack of fever, with all the symptoms of evident constitutional reaction accompany the local irritation, while at other times the system seems wholly insensible to what is passing within the scrotum.

The matter effused into the midst of the tunica vaginalis offers this peculiarity, that it is soft, pasty, or semifluid, and forms, in the strictest sense of the word, matter or plastic lymph. In a considerable number of cases there is along with it a certain proportion of serum; but scarcely ever albuminous shreds or true pus are secreted.

The effusion continues during the advance of the inflammation. Its reabsorption is effected by degrees, so that in about twenty days, a month, or six weeks, the parts may be restored to their natural size, affecting apparently the envelopes of the scrotum, which were more or less thickened, and the testicle, the swelling of which is an almost necessary consequence of the primary disease or the subsequent operation. Whilst the more fluid parts of the effused matter are being absorbed, its solidifiable portion becomes organized; vessels traverse it, and insensibly it becomes blended with the two sides of the tunica vaginalis. Being ultimately resolved into cellular tissue, it so perfectly unites the two layers of the serous tegument which had secreted it as to leave behind no cavities between the testicle and the neighboring layers, which is in fact saying the result is a total obliteration of the cyst itself. This is the professed aim of all surgeons, be the operation to which they resort what it may. It is this result which one and all have pretended they could attain by extolling the varied practises of cauterization, incision, the use of pledgets of lint merely, or lint smeared with medicinal preparations, ligature, excision, the introduction of tents, ribands, canula of elastic gum or of metal, setons, or any irritating liquid whatsoever. And from this statement it follows that it is in reality admissible, since the object is the same, for any one to modify the treatment of hydrocele at pleasure, according to his peculiar views or the personal experience he may have acquired.

From a remark made by Pott it would seem that he did not consider the disappearance of the vaginal cavity as indispensable. An opinion upon this subject, has since been formally promulgated in England, which is in opposition to that of almost every other practitioner of the day.

Mr. Ward has in fact asserted positively that hydrocele is sometimes recovered from, even when the serous tunic of the scrotum preserves its original dimensions. Mr. Ramsden is of the same opinion, and if I may judge from an essay by Mr. Walsh, Mr. Kinderwood, another surgeon, has predicated on the fact, a new method of operating yet more simple than any of which I have spoken. His plan is to divide the whole of the tissues down to the tunica vaginalis, of which membrane a small portion is to be dissected off and excised, and then the liquid having escaped, the edges of the wound are to be reunited by the aid of a stitch. Although I do not participate in the hopes of Mr. Walsh and his countrymen on the subject of this operation, I cannot omit to state a fact recently collected at Pitie, which strongly corroborates the

opinion entertained by Pott. The patient of whom I speak was upwards of fifty years old. His hydrocele was of the size of the two fists; I operated upon him by the vinous injection. On the twenty-sixth day after the operation, when the scrotum had regained nearly its natural size, the man fell a victim to an apoplectic attack. Curious to investigate the pathological phenomena, I dissected the parts with great care, and was astonished to find the elytroid tunic entire, its polish natural, and containing nothing save at the lower part a slightly greenish mass of filamentous and gelatinous texture, which had no adhesion whatever to the inner surface of the serous membrane. The testes and general teguments of the scrotum, were in all other respects perfectly healthy.

When the inflammation begins to abate, which it does toward the eighth or tenth day, poultices are generally useless, and compresses moistened either with wine or the aqua vegeto mineralis, ought to be substituted for them. As the resolution of the swelling is sometimes accomplished with extreme slowness, it is proper to hasten it by suitable measures. Poultices of flax seed moistened with the extraction saturni, I have often seen successful. Upon the whole, those remedies which have seemed to me the most effectual have been mercurial ointment, and unguents made with the iodites and hydriodates, alone or combined with opium, rubbed in small quantities on the testicles. A very important precaution throughout the whole course of treatment is to keep the testes securely supported by a suspensary bandage nicely adjusted. Although it is rare to see the inflammation proceed so far as to cause abscess, yet this accident is nevertheless sometimes encountered. The scrotum becomes red, pouts, fluctuates in one spot of its extent, presenting every symptom of a true phlegmon, or a posterne. The indication in this untoward event is the same as in all inflammatory abscesses in general. Leeches, if it be thought possible to prevent suppuration, poultices, and the puncture of the abscess when its existence is evident, are its principal means of treatment. On the other hand, the tumor having diminished about one-third, one-half, or three-quarters of the original bulk, remains stationary in that spot, and the cure is incomplete. Then it is that topical astringents or discutients are singularly serviceable; frequently have they been known to conquer the indolence of the disease, and complete the recovery at the very moment when recovery was despaired of. If however nothing should be successful, all that remains is to try the injection again, unless the solution should be taken to prefer incision or excision. The method of injecting, as I have described it, calls for no other precautions than those in the majority of cases. If however the volume of the tumor be very great, such for example as to equal the size of an adult head, or larger, it would be prudent to follow the advice given by Schmucker, Boyer, and so strenuously insisted on by M. Bertrand; that of making small palliating punctures in the scrotum before the irritating liquid is thrown in, in order to permit the scrotum to contract upon itself, and thus diminish the extent of surface to be inflamed. If it were necessary to fill with warm wine the enormous cysts which some individuals carry about with them, we should have reason to fear, 1st, the reaction from so extensive an inflammation; and 2d, that it would be beyond the powers of the organizm to effect the reabsorption of all the consequent effusion. I operated once without any such precautions upon a man 48 years of age, whose hydrocele, a very

long standing one, was twenty-four inches in circumference. No accident however occurred, and the cure was effected in the usual space of time.

During the throwing in of the stimulant injections, the patient usually suffers pain of greater or less intensity, which takes the course of the cord and spermatic vessels, and which is considered advantageous, as proving the success of the operation and that the irritation has reached a proper height; which it is satisfactory to find extending even into the side, or lumbar region, so that when it is absent, an augury unfavorable to success is predicted. As all persons are not gifted with equal sensibility, and as the tunica vaginalis may be either very thin, or more or less altered in structure, this pain is experienced in no uniform degree. In aged persons, and in long standing cases when a decided thickening of the cyst may be expected, it is well to heat the wine strongly, and to render it rather more irritating than for those in reverse conditions. It is not to be supposed merely because the pain spoken of is not present that the operation will be unsuccessful: experience has shown a hundred times the fallacy of such conclusions.

Unless the operator is extremely careful the point of the canula slips out of the cavity of the tunica vaginalis with the greatest ease, during the emptying and contraction of the scrotum, by the evacuation of the serum or fluid of the injection. An accident so trivial in appearance as this, exposes the patient however to the most painful consequences. The point of the instrument, becoming insinuated between the tunics of the scrotum, the assistant unawares almost inevitably forces into them the irritating liquid. The layers, connected by an extremely lax cellular tissue, offer but a feeble resistance to the fluid which distends them. The result is a violent inflammation, which almost invariably ends in gangrene, if not previously in the loss of the patient. To a case of this kind M. Boyer was a witness; the surgeon had committed the canula to the charge of his assistant, while he himself threw in the injection. The assistant not having following the retraction of the integuments by pressure with the fingers, the wine all passed without the tunica vaginalis; gangrene supervened, of which the patient died. In 1824 I saw a similar occurrence at the outdoor clinique of the school of medicine, where the injection was forced into the thickness of the scrotum. The integuments and subjacent tissues sloughed in almost the whole extent of the scrotum. The constitutional symptoms notwithstanding were mitigated and the patient recovered. This then is a serious accident against which we must strive to guard. Its occurrence may instantly be apprehended by the local pain given by the assistant in his attempts to force in the injection, by the resistance he meets with, and by the elevations around the canula, which moreover is not felt freely moving at its point within the elytroid tunic. The mischief being done, we must without hesitation scarify deeply, and in several places, the scrotal integuments in all their thickness, and even a little beyond the line of infiltration. The antiphlogistic treatment, and emollient poultices should first be employed, after which if gangrene occurs or extends in spite of these measures, local resolvents must be had recourse to.

This occurrence may also happen even when the injection has been fairly carried within the tunica vaginalis. This is a fact not spoken of by writers, but which apparently is not infrequent. Many persons have told me of cases under their observation, and well informed pupils assure me that they have

witnessed it in three hospitals in Paris, in one year. I have myself recorded two remarkable examples. A man, sixty years old, who had a double hydrocele of moderate size, was operated on by myself at the Hospital St. Antoine, in the Spring of 1829. The puncture and injection were made only on the right side. At first he experienced nothing beyond the customary pain. The first, second, and third day, the swelling of the scrotum progressed in its accustomed manner.

Nay, the inflammation was even feeble; but on the fourth day we observed a mortified point on the inferior surface of the swelling, whence, although I lost no time in scarifying the parts, the gangrene marched on to such a degree as to involve the scrotum entirely to the roots of the penis, and giving birth to its usual concomitant symptoms.

We were, however, fortunate enough to conquer it. The sphacelated shreds came away by little and little; the globular tunica vaginalis, bare to the bottom of the wound, appeared to fill up with a softish matter, as if nothing uncommon had happened, and after much careful attention a cure was effected; upon that side also on which no operation had been performed. In the second instance, treated at La Pitie, in the month of November, 1831, no cause had occurred for suspecting that such a circumstance had existed, when on the fourth day I saw appear on the front of the scrotum a large slough, unattended by pain, redness, or any notable sign of inflammation. No reaction was set up; the mortified tissues were gradually cast off, and cicatrization was insensibly perfected. To what cause are we to attribute the reason of this gangrene? Certainly not to effusion from the canula of a portion of the urine between the layers which separate the tunica vaginalis from the skin.

It is conceivable, that by too great a distension of the cyst by the injection it might easily be separated, so as to permit the transudation of a few drops of the irritating liquid. I should not be astonished if this had really been the case with the second patient of whom I have spoken. But as in both cases the symptoms were delayed until the fourth day, it is scarce possible to admit such a solution. The wiser course would be, at least in my two patients, to refer the cause to their feebleness and a want of reaction, or the state of alarm into which they were brought. Divarications of the tunica vaginalis across its fibro-cellular lining, which, as M. Dujardin has said in his essay, must be easily effected, may naturally produce the occurrence I have alluded to, and to them it has doubtless been more than once owing. This simple statement, affords in my opinion a sufficient reason why surgeons should avoid distending the cyst by their injection beyond what was effected by the hydrocele itself.

I think also, that the use of too large a canula, by its leaving an aperture large enough to allow the after-exudation of a few drops of liquid from the tunica vaginalis, between its exterior surface and the skin, is likely to bring about the difficulty in question, and that for this reason it should not be employed.

Two other accidents are also liable to occur in performing the operation for hydrocele. The one hemorrhage, the other puncture of the testicle.

The former, first pointed out by J. L. Petit, and on which Scarpa has so particularly insisted, can result only from three causes; 1st, from a wound

of the arterial branches sent off to the scrotum by the external or internal pudics, and the epigastric; 2d, from an injury of the vessels of the testicles; 3d, from sanguineous exhalation on the inner surface of the tunica vaginalis. From none of these causes it is easy to conceive any immediate danger. In a natural state at least, none of the vessels are so large as to render its being opened justly alarming. As to the steps to be followed, they are reduced to opening the bleeding place largely, provided the duration of the evacuation is such as to threaten serious consequences.

The second accident, viz., puncture of the testicles, arises only in cases where it has been impracticable to ascertain accurately the situation of the cord, or the seminal gland itself. Dupuytren, Boyer, and almost all surgeons of extensive experience have witnessed the event. The pain which it causes, besides being extremely acute, is of a peculiar character. The organ sometimes becomes violently inflamed, and may go on to suppuration. Still the accident is less dangerous than might at first sight be imagined. A patient, in whom this happened, and in whose testicle the end of the canula stuck so fast as only to be detached by the injections, experienced none of the usual concomitant symptoms of the operation by injection. Whereas in another an abscess ensued, which I opened, and which for several weeks made me apprehensive of the loss of the prolific gland.

Congenital hydrocele, upon which Vigneni of Tours entertained the first fixed views, requires a somewhat different treatment. It is often sufficient to return the fluid into the abdomen, and to prevent its return into the scrotum by a firm compress maintained for several weeks on the abdominal ring. Some authors think so well of this proceeding as to suppose it renders all others useless. There are individuals who cannot bear the remedy, or in whom it is resisted by the disease; such for example as those in whom the testicle, notwithstanding the accumulation in the tunica vaginalis, has remained in the abdominal ring, of which cases it would appear that M. Dupuytren has encountered a number. It is curable by injection, like the common hydrocele, but its easy introduction into the peritoneum, would, it is clear, expose the patient to very formidable risk, unless means were to be adopted to prevent the occurrence. If then it is determined to practise it, we should, in conformity with the advice of Desault, have an assistant to compress carefully the inguinal canal during the operation to cut off all communication with the cavity of the abdomen, which compression might be subsequently continued by means of an appropriate bandage, until the obliteration of the cyst.

A young man, seventeen years of age, on whom every other method of cure had been tried in vain, was treated in this manner, in the hospital of Tours by M. Mignot, in 1818, and with complete success. It is still to be feared that in spite of the pressure the inflammation may travel from the tunica vaginalis to within the peritoneum; but it is well to state that these artificial inflammations are for the most part rarely dangerous, not spreading as those do which spring up spontaneously beyond the seat of the material irritation. It would even seem that the introduction of a quantity of wine into the abdomen is not necessarily fatal. M. Jules Cloquet has published a case in which a large part of the injection passed into the peritoneum notwithstanding the care of the surgeon, but in which the symptoms were never such as to threaten the life of the patient.

If the hydrocele be an encysted one of the cord, injection might equally be tried; but as these cysts are usually composed of cells, and it is to be apprehended that one of them may extend into the inguinal canal and be ruptured in the abdomen at the time of the operation, it is proper I think to give the preference to incision; until at least we have attained a positive certainty that there is but one cell, and the limits of that one exactly defined.

In the female, hydrocele is so rare a disease, and of so little moment, although mentioned by Ætius, by Paul after Aspasius, and by most subsequent writers, that it may be treated by injections, excision, cauterization, and incision, and with a like chance of success as in the other sex.

The labors just published by M. Sacchi, added to the observations of Paletta, Scarpa, and Monteggia, while they prove that its most common seat is in the canal of Nuck, show also that it should be treated in women as in men. In children the liquid of the injection should be less stimulating, and heated to the temperature only of 28 or 30°. Old persons in whom the tissues possess but a feeble vitality, and the tunica vaginalis particularly is little disposed to take on the adhesive inflammation, are ordinarily advised to dispense with a radical cure, and to confine themselves to evacuating the fluid at intervals by a simple puncture.

Where hydrocele is complicated with a hernia, it is obviously proper to restore the intestine before making the puncture or injecting. Supposing the hernia to be irreducible, every possible precaution, at least, must be taken to determine the precise seat of the serous effusion.

If the descended intestine, accompanied by hydrocele should become strangulated, it would be possible to cure both diseases at one operation by kelotomy, properly so called; taking care to open the tunica vaginalis freely, as well as the hernial sac. Where it appears in an old sac, as Le Dran describes in a cyst upon this sac or any part of the scrotum, the same precautions and treatment will be demanded as in ordinary encysted hydrocele.

When we are not permitted to attempt the radical cure, we have always the palliative one to suggest. This, which consists in evacuating the elytroid cavity by a puncture, repeated as often as the swelling becomes inconvenient, has the additional advantage of resulting in some cases in an ultimate radical recovery. A young physician has recently related to me the case of a patient, who in eight days was cured of a hydrocele which had lasted three years, by running a long needle accidentally into the scrotum. I am not sure that acupuncturation is not considered as one of the radical methods of cure in India. Moro, in England, has recently published a fact not less remarkable; that of a hydrocele which he cured in six days by piercing the scrotum, including the tunica vaginalis, with a needle, which was left in the part as a seton. Lastly, it yet remains to be seen whether methodical compression by retractive plasters would not sometimes succeed in dispersing the affection in persons who will not submit, or who cannot be submitted to any of the methods generally practised for obtaining radical cures.

§ 3. *Ectomia, or Amputation of the Scrotum.*

The scrotum is at times attached by a degeneration, known to authors by the names of "Glandular disease of Barbadoes," or of "Andrum," of "Elephan-

tiasis, or sarcoma lardacea of the scrotum, and for which ablation or removal is about the only cure. M. Larrey states that he has often observed it in Egypt, and calls it "oscheochalasia." This degeneration, so common in India and some countries of Africa, has long remained unknown amongst us. A proof of this is afforded by the history of the poor Marabout, so *naively* related by Dionis. By those who would see the most accurate details on the subject, the labors of M. Roux, the essay of M. Delpech, the work of M. Boyer, the Clinique Chirurgical of Baron Larrey, &c., may be consulted with advantage. Although surgeons were formerly in the habit of removing the testicles as well as their covering in performing this operation for the destruction of the disease of which we are speaking, the distinguished professor of Montpelier was not the only person who had remarked, that amidst this singular disorganization, the genital organs remained for the most part unaltered, nor was he the first who projected the idea of preserving them and confining himself to the removal of the morbid tissues. Numerous older writers, confounding sarcocele and the other scrotal diseases under the general head of *fleshy hernia*, have expressly advised the protection of the testicles, when found sound amid disease of the tissues. "Let the skin," says G. de Salicet, "be sliced with a razor, then the carnosity thou findest there be raised from the testicle, and leave the (testicle) if it be not wounded." Although M. Roux, on the occasion of a fact such as that which now engages our attention, had first proclaimed the principles on which M. Delpech has so strongly insisted, the case of the latter gentleman, is still the most remarkable yet known.

The patient was named Authier, an old soldier, and had long labored under an elephantiasis of the scrotum, which had attained an enormous size, and was said to weigh sixty pounds. The surgeon preserved all the integument which could be saved from the root of the tumor, of which he formed several portions of such a shape as to allow of his covering with them afterwards the testicles and virile member; dissected off these flaps and turned them up, one on the hypogastrium, the others on the inner side of either thigh; exposed by the dissection, the penis, cord, and both testicles, each covered only by its proper tunic; wrapped the upper portion of integument around the penis as a cap to cover it; brought the latteral portion in like manner over the testicles; and thus by the aid of numerous stitches, contrived to form a new scrotum, and a sort of sheath for the generative organ. This splendid operation was to all appearance attended with complete success. But the patient, who was naturally very intemperate, and had moreover caught cold in going from Montpelier to Perpignan, was attacked after the lapse of some months with internal inflammation, which proved fatal.

We are told by M. Larrey, that in 1816, in the presence of MM. Ribes and Puzin, he performed an operation very similar to the above, from which it differs only in so much as that the tumor was but five or six inches in diameter. It would appear also that the same surgeon had recourse to it in Egypt, in which during his residence he thinks he has seen tumors of this character weighing one hundred pounds. It would seem, too, that an operation which made a great noise in its time, performed by Imbert de Lones on the minister Charles Delacroix, was called for by a similar affection, and that it would have been possible to have saved the testicle by simple ectomia of the scrotum on

the plan of Delpech, instead of sacrificing it. It is proper to remark that this affection does not appertain exclusively to the male sex, and that on a female the operation would be infinitely more easy, and less dangerous. In fact as no important organ exists in the mass which is to be removed, the extirpation becomes quite as easy as that of a sarcoma, or cancer; on any other part of the body, and this it is which accounts so perfectly for the success obtained by M. Talrich, in the case which M. Delpech has recorded.

Our aim, in an ectomia of the scrotum, being to remove all that is diseased and to preserve unimpaired all that is sound, the steps of the operation will manifestly be liable to various modifications according to an infinity of circumstances: such as the size of the tumor, the involvement of one or both scrotal sacs, and the facility which one situation or another affords for obtaining the requisite quantity of integument for covering the denuded parts we are unwilling to remove.

All therefore which can be said as to the manual proceeding, is that the healthy coverings are to be looked for at the root of the tumor, so as to cut from them flaps of a form and size sufficient and suitable before we proceed to the removal of the diseased mass; that avoiding these we are to penetrate to the sheath of the cord, or to the tunica vaginalis, on the one side and on the other as far as the fibrous envelope of the penis, where the affection extends in that direction: the object being to strip these organs of all which surrounds, and leave behind no remnant of morbid structure; and with the understanding that if the testes are found seriously affected their extirpation is to be on the spot effected. An alteration is to be looked for in the increased length of the spermatic cords.

It remains to be known whether this alone will justify the removal of the seminal organs if otherwise healthy. M. Delpech is of opinion that it will not, and that they will ere long resume their natural condition. I agree with him in opinion, that Mr. Key might have avoided their excision in the patient under his care during the last year, whom he relieved of an enormous scrotal tumor. Can the same be said of the Marabout, operated on by M. Clot on the 27th March 1830, in whom the tumor weighed one hundred and ten pounds, without counting a quantity of serum which escaped during and after the operation. If with a tumor so large no hope of saving the testicles could have been entertained, it might I think have been accomplished in the person from whom Raymond removed one of the weight of twenty-nine pounds only, The Egyptian patient of M. Clot completely recovered.

To conclude; the only general rule which can be laid down on the subject of ectomia, is the following. Remove the entire thickness of the degenerated tissues, and preserve uninjured the important organs within, provided they be in a natural condition.

Nothing can be said about the dressings, unless that the flaps are to be laid down with all possible exactness over the parts they are intended to cover; that sutures, twisted or simple, are almost indispensably necessary to preserve coaptation. They are to be covered with lint, and surrounded by compresses, adapted to effect a moderate pressure in an equal and uniform manner upon all the outer surface, so that between them and the subjacent tissues no spot shall remain uncovered.

§ 4. *Castration.*

This is an operation which has for a long time been advised only as a remedy for intractable diseases of the generative glands. Happily in our day it is performed no longer for objects of luxury, as was hitherto done all over Europe. We no longer hear the act of Semiramis, who directed the castration of all the feeble men of her territories, in hopes of having none but robust and vigorous offspring, palliated by modern surgeons; nor do they maintain, as did Brunus of Longo-buco, the right of masters to emasculate their servants in order to render them safer protectors for their wives. Even Italy herself has abandoned the brutal system; introduced into her realms by the popes, under the pretence of giving to man a softer and more melodious voice.

For objects like these castration is no longer in use except in the East, and in countries where slavery and polygamy are still permitted.

As a therapeutical resource it has often been put it practice in the radical cure of hernia and of hydrocele. It was in old times a method much resorted to, although by G. de Salicet, those who practiced it in his day were denounced as ignorant; and during the period of the writings of Cantemire the Albanians themselves looked upon it as useless and dangerous. If the practice was still prevalent among us within half a century, it would only, as was observed when speaking of hydrocele and hernia, be among quacks and persons ignorant of medical science. It is now never resolved upon unless for diseases of the testicles themselves, and exclusively for such as are thought otherwise incurable. It is employed for instance in cases where a bruise, laceration, or some traumatic lesion has entirely disorganized the gland, when it has began to secrete pus, or has become the seat of scirrhous, cerebriform, colloid, melanotic, or tubercular degeneration; but still with the certainty that by no other treatment could the health of the patient be preserved. It is essential, to afford any hope of success, that the affection be entirely local, uncomplicated with the viscera, and that no trace of it should elsewhere exist. Even were the viscera to be found unaffected, it would be imprudent to perform the operation in a case in which the cord was involved to any distance within the ring. Still, if the degeneration were only colloid or tubercular—the result of previous inflammations—with no mixture of scirrhous, encephaloid, or melanotic disease, we might perhaps follow the cord either into the iliac fossa, as did Le Dran, or at least adopt the recommendation of Lapeyronie and seek for it in the depth of the inguinal canal.

Four different methods were in use among the ancients for performing castration upon healthy persons whom they wished to emasculate. *Attrition*, which consisted in violently bruising the organs and thus produce its atrophia; *crushing*, which was effected by squeezing it between blocks of wood; *extraction*, or tearing it forth; and lastly *excision*, were alternately preferred. Of all these, still partially retained in veterinary medicine, the last alone remains—and is that called by Paul, ectomia—in human medicine. The term *castration*, can then be understood to mean at the present day neither attrition, squeezing, or extraction of the testicle. Ectomia itself, which is by no means similarly performed by all surgeons, is thought by many capable of being

superseded by other methods infinitely more simple, and which I cannot allow myself to pass over in silence.

The method proposed by M. Maunoir.—Dr. Maunoir, a distinguished surgeon of Geneva, conceived early in the present century the plan of curing sarcocele without the removal of the testicle, by baring the root of the cord by the division of its enveloping coats, separating the vessels, and including them in ligatures. Many successful results are stated to have been obtained in this way; and within a short time a case has been quoted at the academy of medicine, in which the operation was attempted with success. All that can be attributed to this proceeding is, that by suspending the flow of blood to the affected gland it may become atrophied, which appears to offer no great gain to the patient. Reason would lead us to believe that, although it might succeed in certain cases of degeneration resulting from a simple chronic inflammation, in a genuine sarcocele it would prove insufficient. To varicocele, which is serious enough to expose a patient to some risk, it would seem much better adapted. For this all the ancients performed it, preferring however to tie the veins. Paulus Æginetus describes it in detail, in these words; "we must protect the scrotum and the cremaster, tie the veins in two places, and cut them between the ligatures." The same advice is given by F. de Piemont and P. Forestus. And since 1820, Sir C. Bell has satisfactorily shown that no inconvenience results from the artery and vein in a single ligature. It is surprising that the Academy, and also M. Amussat, who thought himself the inventor, should have imagined this to be of recent origin when communicated to that body in 1828 and 1829.

Mr. Morgan's method.—In England a somewhat different course was adopted. Instead of interfering with the vessels Mr. Morgan recommended the attacking of the vas deferens itself. Messrs. Lambert and Key, who adopted the principle of this surgeon, each cite a successful case in its favor. After having denuded the spermatic cord, they seek for and detach the vas deferens, and excise a portion of it two inches in length, close the wound immediately, and a permanent cure is speedily effected.

Did either of these methods encourage the hope of restoring the organ to its original healthy condition, or of preserving the exercise of its functions, it would richly deserve to be adopted notwithstanding its uncertainty. Unfortunately this is not the case, and they will never I fear obtain that rank in science to which some are willing to exalt them.

Castration properly so called comprises three distinct periods; 1st, that of the incision of the integuments and covering tissues; 2d, the section of the cord and the application of styptic measures; 3d, the dressings.

Period the 1st.—It is unnecessary, as has been said by Paul, to excise any portion of integuments which remain healthy, or have contracted no adhesions to the tumor, or when the tumor is one of small bulk. Beyond this the first incision may be indifferently executed, either by a flap, or from above downwards to deeper parts, as is done by most modern surgeons. The incision is in either case to extend from a little above the ring and descend to the bottom of the scrotum. Although some little more advantage be gained by embracing the tumor at its posterior part, than by making tense the integuments in front of the testicle during their division, as is recommended by M. Dupuytren, this is more a matter of taste than of necessity. When once the

skin and its lining tissues are divided, nothing is easier than to insulate the testicle by free strokes either with the fingers in imitation of Benjamin Bell, with scissors, or what is infinitely better with a convex bistoury, until the whole circumference shall have been completed.

The assistant then separates the lips of the wound, while the operator with one hand seizes the tumor, or *vice versa*, in order to stretch the parts to separate them in the suitable direction whilst their adhesions are destroyed with the other hand. The only precaution necessary to be taken, is that of not carrying the knife too near the penis or septum of the dartos for fear of wounding the urethra or the testicle of the other side. There are many surgeons who are of opinion that this plan should always be followed, however large the sarcocele, unless the integuments are diseased. The proceeding is liable to real inconveniences, and to remove a certain portion of skin with the testicle, when the bulk of the cancer exceeds certain dimensions, which is the mode advocated by Sharp and De la Faye, and long before practised by Paul of Egina, is undoubtedly a preferable one.

An elliptical incision, carried like the former, from above the ring to the lower part of the scrotum, should in that case be made to include a cutaneous portion, large or small according to the size of the testicle. In the fear that pus might stagnate in the incision, and wishing to avoid the scar in front, and being also of opinion that the morbid alterations of the skin were more frequently met with below than above, Aumont has recommended that the incision be made on the inferior surface of the tumor, and not on the anterior as it is usually made. There is no doubt that this advice may be followed; I have seen it done by M. Roux, and have twice done it myself. When the integuments are perfectly sound in that part in which it is usual to incise them, while they are more or less disorganized in the opposite situation, this method may even be strictly accurate. But how childish is it to attach the least importance to the scar being in front rather than behind, under the idea that it is more visible from above than below! With regard to the stagnation of pus, experience is sufficiently ample to prove the facility with which matter will escape by the incision when made according to the old method; whilst that of M. Aumont presents so serious an objection in the greater difficulty with which the cord is insulated to within the inguinal canal, that I once saw M. Roux sincerely regret that he ever adopted it.

Period the 2d.—As soon as the dissection has surrounded the tumor, and the cord is denuded to the extent of the disease, the surgeon is to attend to separating the parts which it is his intention to remove.

Upon this point of practice it is, that the greatest discrepancy in medical opinions exists, from which two very different methods have resulted. In one, the cord or its vessels is tied before the section of it is made; in the other, a plan totally opposite is pursued; each containing many diversified proceedings.

Method 1st, is that recommended by Paul of Egina, who included the whole cord, by the advice of Celsus, in one strong ligature, placed between the diseased mass and the ring. Most operators at every period have pursued the same course; though some, following Purmann, advise the location of the ligature as near as possible to the ring; while others again, with Barbette and Bertrand apply it immediately beyond the epididymis. Some,

Hænel among the number, place it at a distance intermediate. Some are found who, at the recommendation of Franco and Pearson, draw the ligature at once with great tightness, while others, as O. Acres, compress it just enough to impede the flow of blood. Gauthier, for instance, is among those who tighten it only by degrees, increasing a little each day until it cuts through the tissues completely. Pare, and a large number of others, advise us to pass a string several times doubled across the cord, cut it into halves, and separately tie each portion. Ravaton, wishing to leave the vas deferens entirely free, places his ligature in the same way as Pare, but ties that portion only which appears to him to contain the vessels. Some surgeons, agreeing with Birch as quoted by Sprengel, carry a ligature up underneath the parts to a considerable height, and put on another an inch below it, with which they compress the vessels before cutting through the parts beneath. Lastly, we must further remark, that it has been deemed advisable by Theden and Flajani, to interpose a small compress between the ligature and spermatic cord, while by Pelletan a simple plate of lead is preferred to the compress.

Method 2d.—Those who first remove the organ are not less divided in opinion as to the attention to be afterwards paid to the cord. Cheselden, from an observation he had made of the vessel being entangled by the ligature on the cord slipping before it, and the hemorrhage checked, was one of the first to propose the ligature of the arteries only. Le Dran preferred to protect them with a ligature placed beneath, to rub them between the fingers at some distance below, but to tighten the ligature only in case the friction should prove insufficient to arrest the hemorrhage. White and Korb assert the successful imitation of this practice. J. L. Petit applied a small graduated compress upon the ring and employed no ligatures, while Ponteau was content to turn the end of the spermatic fasciculus over on the pubis. Runge equally dispensed with a ligature, by twisting the cord on itself several times after a cautious dissection before he cut away the gland. Smett, Schliting, and a multitude of others, declare that all these are futile precautions: that men who in fits of anger or despair castrate themselves employ no such measure, and yet do not perish from hemorrhage. It would be a mistake to fancy that this diversity of opinion existed no longer in our own time. Ligature of the mass retains many advocates, though there are many surgeons who do no more, than to insulate and tie each vessel separately before cutting away the testicle from the cord. Bichat, M. Roux, and Sir C. Bell, have advised us to cut every thing away but the seminal canal, then to seize and tie its arteries, and afterwards to cut the vas deferens itself. Others cut away the sarcocele as soon as they have dissected it away from its connections and coverings, and immediately search either with a hook, tenaculum, or with forceps, for the bleeding vessels in the upper cut extremity of the cord. It is surprising that so much discussion should have been carried on, and still continued, as to the relative value of a measure, the choice of which is itself such a perfect matter of indifference. In most individuals, the artery or arteries of the cord being so small as to be left to themselves after they are divided without any danger, it appears to me that Le Dran's friction, Petit's compression, torsion, or the turning over of Runge, will all answer, and may be tried by any one so disposed without risk. Nor can I deny the probability of equal success of ligature, in the manner of Boyer, Dupuytren, Delpech, and Roux, who have

adopted the principles of Cheselden and Bromfield. The cure will ensure equally well whether the cord be entirely constricted or only partly; and whether the pressure be gradual or immediate. The chief point is simply to ascertain which is the easier and safer of the two, to tie the whole in one ligature, or to apply no ligatures until after the removal of the mass.

Siebold, had the other antagonists of the former method, ground their rejections to it on the danger which is sometimes incurred by including in one ligature the vas deferens, the strings of nerves from the venal plexus which accompany it, the branch sent off by the genito-crural nerve, and the other tissues whose incision is not indispensable, on the fact that such a ligature must produce violent pain, and incur the risk of convulsion and even of tetanus, and lastly, on the length of time which sometimes elapses before it cuts through the part and can be removed from the wound. Some have even added, that constriction of so great a quantity of different substances, will soon produce loosening of the string, which would be insufficient to close the arteries.

To this it may be replied, that the strangulation does but cause an acute pain for a second, even when it ruptures the continuity of the nervous filaments and of the vas deferens; that hemorrhage has never been seen to proceed from vessels thus strangulated; that tetanus and other nervous calamities are no more to be feared from this than from any other method; that the patient treated by this method by Morand, and who died of locked jaw, the disease was induced by a wholly different cause; and that in addition to all this, a case has been published in the Review Medical by M. Couronnee, of a person who died with tetanus following castration, although the spermatic cord was not included in a general ligature. I have seen the thing done at least twenty times within four years, at the military and civil hospital at Tours, by M. Gouraud; by Richerand and Cloquet at the Hospital St. Louis; by M. Bougon at the Hospital of the School; and likewise by many other practitioners. I have done it myself in nine cases; and in all these cases, fifty or more in number, the general ligature was employed without the occurrence of a single accident which could be referred to its use. The observation of Mursinna, Wilmer, Loder, and Dietz, have likewise refuted the objections of Siebold on this head.

Suitable precautions being taken, a successful result from separate ligatures is, it is true, not less frequent; but it is clearly attended with rather more difficulty, as it is not always easy to discover the vessels, as the frequent searches for the purpose lengthen the operation uselessly, and as dangerous hemorrhage has sometimes arisen from the ends of the arteries after this treatment.

There is peculiar to this mode an inconvenience which may equally create anxiety, and which I saw happen in a person on whom M. Roux operated. Whilst the professor was in search of the artery, the seminal fasciculus escaped from his fingers, and ascended high up beneath the preserved integuments; haste was made to seize it with forceps and to bring it without, to be included in ligatures which were placed rather uncertainly. The hemorrhage appeared to be suspended, but towards evening an abundant flow of blood became evident, was repeated frequently throughout the night, and threatened to prove fatal. Much has been said by authors about this dispo-

sition in the cord to retract itself; and hence the use of preventive ligatures and a host of other precautions designed to guard against a similar movement.

Nevertheless, no constituent part of the cord is contracted. The testicular vessels and vas deferens, lengthened more or less by being dragged down by the suspended weight, only appear capable of retreating towards the abdomen when they are relieved of their burden. It does not appear how the enveloping or covering tunics can operate the least reaction in this direction. The fibres of the cremaster at the utmost could raise it but a few lines. It is incorrect then to say that when once free the cut extremity ought to ascend considerably upwards. Nor is this tendency in it now for the first time denied. A long while ago the error had been corrected by M. Flaubert, a distinguished provincial surgeon; M. Senateur has stated in his essay many facts to overthrow it, and Mr. Charles Bell has combatted it in England. The following is all that happens: if, by the long standing of the sarcocele, its size, or any other cause, the cord has been considerably elongated, as soon as its division is affected it tends indeed to gain the inguinal passage; but the parts do but yield to their own elasticity, and only to approach a little nearer to their primitive situation. Nothing like this happens when no elongation of the cord exists, when the diseased testicle maintains its original distance from the ring; and then the retraction spoken of is in nowise to be apprehended. To conclude our investigation, it can only become of consequence in a few individuals as when we cannot separate the cancerous mass at least an inch from the ring; whence it follows that it is scarcely necessary to heed it when the cord itself is unaffected by the disease. Arnaud, Marechal, Garengeot, Bertrandi, and others, having remarked its root to be surrounded by fibrous tissues and tense lamina, thought that the ring should be relieved of these bridles, so as to prevent strangulation, to which they attributed numerous dangers; but which must be of rare occurrence, since it is unnoticed by any modern authors, notwithstanding the general neglect of the advice given by Garengeot.

The manner of dividing the cord could undergo but little alteration. The hot iron preferred by Roger de Parme, Brunus, and others, finds defenders no longer. The scissors recommended by Scultetus are evidently less convenient than the bistoury. In using the latter instrument, the recommendation of Leblanc to make the incision in the form of the mouthpiece of a flute is useless. While the testicle is supported by an assistant, the surgeon seizes hold of the cord with the left hand a little below the ring or the spot upon which the ligature is, and cuts it at one blow from behind forward, or from before backward, perpendicularly to its axis. It is not likely that hereafter the division of this organ will be trusted to the thread as a means of detaching the parts by insensible degrees, as if we were treating a polypus, which is the plan proposed by Runge or Leblanc. If the lips of the wound, by being too large and extensive, should be longer than is proper to admit of their approximation, it would be proper to resect them immediately, otherwise they will roll inwards and render the healing long and difficult. This tendency of the sides of the scrotum to be turned inward seems naturally explicable by the arrangement of their anatomical elements; the remains of the cremaster, if it be not wholly destroyed, and the layer which constitutes the dartos, being

to a certain extent endowed with the power of contraction, retreat more or less upon themselves, dragging necessarily the cutaneous tissues with them in the same direction.

Procedure of Zeller or of Kern.—A certain surgeon, Acoluth, fearing hemorrhage beyond all things, conceived the idea of obtaining a gradual sloughing of the tumor, by drawing down the tumor from below and strangulating it at its root by a silken ligature placed above it. Aristotle and after him Haly Abbas, advise the excision of the testicle by a razor carried beneath the suspending part. In Germany the plan is somewhat differently effected. Having noticed the fact that maniacs and others amputate their own testicles and scrota at a single stroke, it occurred to Zeller to convert the idea into a regular method of operation. His plan is to embrace the whole sarcocele with the left hand, causing an assistant to draw up the integuments on the upper side with his hand, he cuts away at a single stroke of a scalpel or bistoury the whole cancerous mass stripped of its coverings, and merely places a sponge dipped in cold water at the bottom of the wound to guard against hemorrhage. A surgeon of Vienna, since desirous of extending the method, has put it frequently in practice, and as he says with uniform success; but with a most important modification however, since he never lets go the cord until it is surrounded by a strong ligature.

The method of Zeller allows of the removal of the testicle with wonderful celerity, and renders castration as simple as it is easy. And I have thought that as the integuments have not been dissected off, it is possible to close the wound much more quickly than by the usual method. But it renders general ligature of the mass of the cord rather more difficult, and evidently ceases to be applicable where the disease is rather large or its envelopes are in a morbid condition. Instead of occupying the scrotum, or hanging pendulous without, the organ to be removed may be retained within the thickness of the abdominal parietes in the inguinal canal, either because it had never descended into the scrotum, or because it had afterwards accidentally reascended, of which a remarkable instance is related by Rossi. In some manner or other it may then change into sarcocele, as proved by the examples adduced by Chopart, Boyer, and Robert. Then we see how difficult and dangerous must be the operation. How are we to judge before hand of the condition of the cord? how define exactly the extent of the disease? It is to be feared also that the peritoneum may be opened contrary to our wish, as happened to M. Nægele, or that it might be necessary designedly to cut through it in order to remove the entire disease.

Under these circumstances it is necessary to cut through layer after layer all the coats which envelope the tumor; isolate it gradually by a cautious dissection, and keep carefully in mind the proximity of the peritoneum, of the epigastric artery, and even of the iliacs themselves. The cord being arrived at, I think it most prudent to include the whole in a general ligature than to tie each vessel separately. But if the tissues should be much altered by the chronic inflammation, and confounded with neighboring parts, this species of ligature would then deserve the preference, and the string should be passed with the assistance of crooked needles. In a case related by M. Puisser, it was necessary to divide the cord more than three inches above the ring, and the patient notwithstanding recovered equally well.

The wound resulting from the ablation of a testicle, by any method of operation, contains always a number of vessels which claim the surgeon's attention before he proceeds to dress it. Exclusive even of those of the cord, one or two are usually to be found without, and these generally the largest; the inferior angle of the incision has some also, which are given off from the pudic by the superficial perineal artery. It is not uncommon to find one on the inner surface, which is a branch of the artery of the septum of the dartos. Usually before the operation is over these vessels have done bleeding, and in some people we look for them afterwards in vain; hence the caution to pause and twist, or tie them as they are cut. However, if they do not reappear beneath the sponge used to detect them on the surface of the cut, they rarely result in hemorrhage when abandoned. Also, if they be tied, and they are then thought secure, we must be aware that during the night following, or in three or four hours afterwards, the dressings become soaked with blood without the existence of actual hemorrhage.

The Manner of Dressing.—The ancients often had recourse to sutures, and endeavored to effect union immediately after the removal of the testicle. Towards the end of the 17th century however, union by the second intention was alone attempted. A number of English, German, and American surgeons, M. Delpech, and other surgeons practising in the south of France, are it is true, endeavoring to establish the former method; but I have not seen either in Serre's book, or in any foreign works, any well established fact of complete cicatrization directly occurring in such a wound.

To be really indispensable, sutures, simple or twisted, must be confined to cases in which no ligatures are put on any of the vessels and mere torsion has been practised, so that the cut edges may be placed together accurately, and the preserved integuments upon the subjacent tissues; whence arise numerous difficulties to be overcome and more pain to be endured. The usual mode of practice offers infinitely fewer difficulties. A fine peice of linen, pierced with numerous holes and spread with cerate, is spread like a veil over the wounded surface: over which some small balls of lint are to be laid. The sides of the scrotum are likewise to be protected by lint, lest they should strike the upper parts of the thighs. Several lint compresses (plumasseaux) are to be laid over the whole. Some long compresses, a large suspensory or double spica bandage completes the apparatus and the dressing.

The accidents which it is to be feared may occur are the same that follow all other great surgical operations sometimes, and require the same treatment. Hemorrhage when it happens does not always acquire the precipitate removal of the dressings to discover its origin and secure the vessels. It is often all-sufficient for arresting the bleeding, to sprinkle or bathe them in cold water, or with the aq. saturni, and renew the application every hour at least. Should the flow continue, however, to such an extent as to weaken the patient or lead to the belief of an internal effusion, we must take off the apparatus without hesitation, remove the clots of blood, and tie the open artery or arteries; or else when the danger is urgent, resort to styptics, the tampon, or even the actual cautery itself. Where a general ligature has been applied to the cord, and the constriction has not been quite sufficient to strangulate entirely the tissues, the end of the cord may return its vitality, and be converted into a reddish or cauliflower excrescence, which, as

was remarked by J. L. Petit, and as I myself saw happen in a person operated on by M. Cloquet at the Hospital St. Louis, may connect itself with the neighboring edges of the wound, so as in the sequel to give rise to some difficulties. It is indeed probable, even then, that the ligature would end by cutting through the stem on which it is placed, and all that would be necessary would be to repress the growth of the vegetation by astringents or caustics.

If in spite of every precaution the edges of the wound should turn outwards, and the suppuration prove too copious, we should endeavor, to approximate its fundus, and by maintaining compression on its sides, to bring about their union by the second intention as speedily as possible.

Art. 2.—The Copulative Organ.

§ 1. *Phymosis.*

Contraction of the prepuce is a disease which presents itself to the surgeon under three principal forms. When *congenital,* it is troublesome only as an impediment to the flow of urine; in adult age from the pain which is occasioned by it during coition; *as an effect of active inflammation* it may give rise to serious accidents; *when accidental, but of a chronic character,* the entire prepuce may be hardened and thickened, so as to form a hard, inelastic, lardaceous shell, extending beyond the gland to a greater or less distance, which it closely embraces.

A congenital phymosis which depends, as is the case in children, on an undue length of integuments, demands no other operation than that known and practised by religious precept among the Jews and nations of the East, called circumcision. Neither do those cases which result from acute inflammation, such as chancres and venereal lesions of any kind whatever, call for the employment of instruments, unless they render the original affection too difficult to be cut, or cannot be conquered by injections, topical applications, and other appropriate means.

The third species is one but little noticed. When it is of long standing, and of such a nature as to cause difficulty in voiding the urine, no other aid can be rendered than that which is afforded by the division of the contracted circle. The operation is in all cases the same, and it is needful only to remark, that when performed upon a prepuce on whose inner surface ulcerations exist, the wound itself will commonly ulcerate, and that then the use of antisyphilitic measures, local and general, must not be forgotten.

Anatomical Observations.—The penis is inclosed in a tegumentary layer, soft and flexible, which in its reflexion to form the prepuce, becomes insensibly a mucous membrane on the corona glandis; and is lined throughout with a lamellar tissue so supple, lax, and distensile, that it may be drawn backwards or forwards to a distance of several inches. This arrangement, so consonant with the functions of the penis, renders it easy to lengthen, too much or too little, the external layer of the preputial sheath, although by itself is total division would have been exactly of the right dimensions; that is to say, if during the incision the skin is drawn forward, it will be seen to draw back and uncover a portion of the copulative organ; while on the other

hand, much more retracted in an opposite direction, it would return and cover the posterior extremity of the wound. The vessels, which come off from the dorsal arteries of the penis, and sometimes from a prolongation of the artery of the septum or the superficial perineal branches, are found principally on the upper part and inferior extremity of its vertical diameter; so that in proportion as we deviate from the median line is the risk of hemorrhage increased. Happily, as their volume is inconsiderable, they need give no anxiety in this respect, and scarcely merit attention. Lastly, let it be remembered, that in its downward reflection to form the frenum preputii, the prepuce gradually extends its adhesions from the corona glandis towards the meatus urinarius, to such a degree as to offer a much greater length in this direction than in the dorsal side.

The Operation.—Superior Method. The operation for phymosis, as simple as any in surgery, requires for its performance a narrow bistoury, either straight or slightly concave, or a pair of scissors: a director grooved to its extremity and not ending in a cul-de-sac, dressings forceps, artery forceps, a lint compress besmeared with cerate, two or three small soft compresses, and a narrow bandage about a yard in length. The concealed bistoury of Bienaise, employed by Lapeyronie, as well as all instruments specially devised for this object, are wholly useless.

The patient is to be seated on a chair, unless he prefers being in bed. The surgeon, in a convenient position, passes the director beneath the prepuce down to the bottom of the gland. The assistant who supports the penis is now desired to attend to the director also, and to preserve it and the integuments in a proper position. The bistoury, gliding over the groove in the director, reaches the base of the cutaneous fold or replication; when its point is turned towards the skin, so as to pierce the prepuce from within outwards, and then rapidly to cut it through from behind forwards. The incision by puncture of the deep seated parts near the skin possesses the advantage mentioned by M. Richerand, that the patient by shrinking involuntarily himself, completes the operation without trouble to the surgeon. In order to dispense with the grooved director many persons follow the advice of Sabatier, conduct the bistoury flatwise in between the glands and its sheath, and then act as has just been directed.

Some also, to avoid wounding any parts over which it passes, place a small wax ball, smeared with oil or cerate, at the end of the bistoury, which when it arrives at the bottom of the cul-de-sac, passes easily through the wax and the integuments to be divided together. Scissors are now scarcely any longer made use of; acting as they must on very soft and unstable parts, they rarely effect more than a partial division only at the first cut; and the more so that the incision must be made from before backwards. They are consequently employed only to rectify the incision made by the bistoury when it has not equally effected both layers of the prepuce, or when it is wished to add to its length.

Some other surgeons think it necessary to adopt infinitely more minute precautions, for the purpose of limiting the too great extent of the wound, whether inwardly or outwardly. For example, it is the advice of M. Ricord that we should seize the tegumentary fold with two, or even three dressing forceps, in three different places from its free extremity to its base, so as to

stretch it sufficiently, and to allow its section to be made by the knife, or scissors, without danger of the two layers sliding over one another. Besides the inconvenience of such a multiplicity of instruments, which require to be managed by as many assistants, it has moreover this objection, that it is very rarely admissible for a prepuce sufficiently contracted to call for the operation; for phymosis would never admit the introduction of three dressing forceps and a cutting instrument. When we have been careful to draw back the skin, that no folds or twisting may exist on the free edge of the prepuce, and the assistant or surgeon has been watchful sufficiently to stretch the part, the obstacle (which the plan of Lisfranc, as described by M. Ricord is well calculated to obviate) will be but little to be feared. The former of these surgeons, with a view of avoiding the angular projections of the wound, advises us to do no more than excise a semilunar portion on the anterior and dorsal border of the part, which he does with scissors curved on their flat surface; and which excision he repeats in several places along the membranous circumference, if the first section seem insufficient. This procedure, which is useful when the prepuce is long and the malady slight, should however be superseded by the removal of a triangular portion of the contracted ring when any solid advantage is to be gained by a loss of substance. This latter excision would, in fact, be indispensable in operating on a phymosis resulting from chronic induration, as I myself once did at the Hospital St. Antoine, on an individual who had the sheath of the glans converted into a really fibro-cartilaginous shell.

By a preference to the dorsal region, which is advised by most operators, we are liable to extraction of the sides of the incision and their lateral separation from each other, so as to give rise to a very ugly looking rim or edge, which is also sometimes a very troublesome one.

Subsequent excision of the angle of each portion does but very imperfectly remedy the defect of which I speak, and in all cases is far from sufficient. To this result, the method invented by M. Cloquet gives an infinitely less predisposition. It is performed by making the incision at the lower and the upper part of the prepuce. The bistoury is carried on one side or the other of the frenum, which is itself afterwards divided if it appears to be lengthened too far forward. Besides having fewer vessels to encounter in this than the former direction, the wound becomes transverse by the retraction of its edges, which is all in favor of the aperture we desire to augment, and does not leave a deformity as in the preceding case, equally as troublesome as the original affection. It would appear that phymosis was thus remedied by the ancients, for in speaking of it Celsus remarks, "subter a summa ora cutis inciditur, recta linea usque ad frenum, atque ita superius tergus relaxatum cedere retro potest." I have performed this operation eight times, and experience leads me to the belief that it will be a substitute for the other.

Instead of making the incision on the median line, either above or below, we are sometimes induced by the presence of veneral tubercles or ulcers to place it on the side, or on both sides of the organ; but to render this necessary, the prepuce should be extensively altered, as lateral incisions are in general attended with great deformity. It is possible, and sometimes very useful when the constriction extends to a considerable distance, to strike the point of the bistoury in upon the director through the integuments, as is advised by

MM. Heurtault and Tavernier, and not as is usually done, make the puncture from within outwards. Another good rule, also laid down by M. Tavernier, with a view to avoid any error in calculating the relative extent of the incision into the organic layers, is the following; the director once introduced, its point is made to project a little; the surgeon then is to draw back the skin until the rosy border of the mucous layer be distinctly seen. The points being kept in this position by the operator himself or an assistant, he may be sure that the instrument piercing the integuments from the surface to the director, or from the director to the surface, and brought back from the root of the prepuce to its free extremity, will make as neat and even a section as it is possible for it to do.

The operation being completed, the cutaneous replication ascends behind the glans penis. The lint compress is laid on the wound, which is surrounded with a small soft, and two long compresses, or a Maltese cross; to conclude, the bandage is carried down to the extremity of penis, so as to bring it back by circular turns to the anterior extremity of the organ, and again carry it behind where it is to be fastened. A suspensory previously applied would allow this little arrangement to be much more securely effected, and render it much less liable to derangement. It is well to take a turn or two of the bandage or to pass a cravat around the loins; the whole organ may be kept turned up on the hypogastrium. If the dressing be not displaced, it need not be renewed for two or three days; and if suppuration takes place it is really so simple as to require me to dwell no longer upon it. That the wound may remain as narrow as possible in the antero-posterior direction, and may not be tedious in healing, there is some advantage, particularly at the first dressing, in placing the folds or turns of the bandage on the body of the penis, going from behind forwards; and also, in afterwards using, as is advised by M. Tavernier, a Maltese cross perforated in the centre, so that it may leave the glans uncovered while it pushes the divided prepuce from before backwards. By these means the dressings are more solid, and all the tissues are drawn together instead of tending to a separation, as often happens when this precaution is not taken. At a later period I have found it a good plan to draw forward the callous rim which is formed for a good while by the edges of the incision, so as to compress it a little and favor its absorption.

§ 1.—*Paraphymosis.*

If compresses steeped in cold or iced water, which have the property of overcoming strangulation and allowing the prepuce to be drawn over the glans, by reducing the bulk of the cavernous bodies and diminishing the flow of blood into them, are insufficient or cannot be employed, and unless the inflammation or painful state of the parts themselves render it inexpedient, we can always try what can be done by another means before resorting to the operation properly so called. This means is *compression.* By some it is executed by the use of a roller bandage, gradually increasing its power until the reduction of the glans can be made; others operate with their fingers, in such a manner as that the patient is for the most part immediately cured of the affection.

To do this, the surgeon seizes the penis with the index and middle fingers

of either hand, which he crosses behind the morbid ring of the prepuce. His two thumbs remaining at liberty, are to press upon the sides of the glans in such a way as to act in concert with the fingers, but in opposite directions, the glans being pushed strongly back, whilst the prepuce is drawn forcibly forwards as it were to cover the thumbs which are crowding within it. That the fingers may not slip on the skin, it is well to cover each with a piece of thin linen, which has besides the advantage of rendering the operation rather less painful. It would be wrong to refuse a trial to this remedy on the sole ground of the disease having lasted twelve or eighteen hours, and that the parts are swelled and painful. I have resorted to it with perfect success twenty hours after the accident, in a healthy and robust young man twenty-five years of age; and after the lapse of three days in another, and with no more convenience, although the forepart of the penis was extremely sensitive and that several chaps existed on each side of the rim of the prepuce.

This is an operation likely to succeed in the greater number of cases when it is well performed, but of which the mechanism is too simple to require its explanation at greater length to a person intelligent enough to do it as it should be done.

If it do not, however, answer the object of the surgeon, we must resort to the use of cutting instruments. Whilst an assistant holds the penis at both ends, and bends it moderately upon its inferior surface, the operator slides a narrow bistoury flatwise between the dorsal aspect of the glans, or of the corpora cavernosa and its coverings, as far as the strangulation; turns its edge towards the skin if sure of having penetrated beneath the constriction, and in the contrary case towards the penis; and then in the former case by depressing the wrist, in the second by elevating it a little, he cuts it immediately, and if one incision does not appear sufficient makes one or two others in a similar manner.

Now, instead of thus ploughing up the tissues to reach the stricture, would it not be better to incise it at once by its outer surface? I see nothing to render such an operation impossible. In endeavoring to push back the skin towards the pubis, and to turn out the morbid rim in front, the bottom of the circle which causes the difficulty is generally brought into view. Nothing is then easier than to carry down perpendicularly upon it the point of a straight bistoury held like a writing pen, and to make in one or more places with the instrument little incisions, to which the necessary depth may be given without running the risk of erring as in the other method. I give the preference to this method, and with me it answers so well, even in the case of a child in whom the paraphymosis was of three days' standing, and in all the adults in whom I could not relieve by the fingers and thumbs, that I can scarcely conceive of a case in which the former method need be indispensable.

A little lint spread with cerate, lotions of marsh-mallows-water, emollient topical applications, and the most soothing means, are all that is called for after this simple operation, which can only be rendered serious by opening largely into the corpora cavernosa, or by the division of a principal artery of the penis; even then such occurrences would probably prove unimportant.

§ 3. *Stricture of the Penis.*

Since the attention of the profession was directed by Morand to this subject, all practitioners have mentioned individuals who from depravity or carelessness have mechanically included the penis in bonds or rings, from which they could not afterwards withdraw it. Sometimes it is a ring of copper or iron, a circle of gold, silver, or iron, a metallic ferrule; at other times a piece of pack thread, a riband, or even, as was seen by M. Dupuytren, the socket of a candlestick; again, it is an elliptical steel circle, called a "steel," which such imprudent persons pass over the penis so as even sometimes to include the testicles themselves. The parts speedily react upon obstacles like these, which are soon buried in a fissure of greater or less depth; and which by exciting inflammation and tumefaction, are promptly followed by perforation of the urethra, or of the fibrous tunic of the corpora cavernosa, if not by sphacelus itself. Ligatures of thread, cord, or riband, will never seriously embarrass a professional man; the point of a bistoury, or a pair of very sharp scissors being always able to overcome the difficulty, and the same may be said of rings, of rushes, osier or wood. To disengage a circle of ebony, ivory, or horn, scissors of great strength, or cutting nippers, are necessary. The file and the saw become indispensable in the division of metallic substances. A cutting diamond in such a case would be invaluable if it were at hand. Unless it were of extraordinary thickness, the hardest circle would not probably resist a couple of small hand-vices if they could be applied to it.

If the swelling of the part be excessive, the congestion is to be lessened by the previous employment of scarification and punctures. The sides of the fissures are then to be separated as far as possible, so as when practicable to admit beneath the stricturing body a flat piece of linen or metal, as a protection to the parts against the action of instruments. The saw and file are to be used across rather than in the long direction of the penis, and the use of the other means is sufficiently intelligible without entering any further into useless details.

§ 4. *Section of the Frenum.*

The frenum of the penis, like that of the tongue, sometimes projects too far forwards. The result of this, in certain subjects, is, that during its erection it is curved downwards to such a degree as to render coition painful, and emission difficult. The remedy for this inconvenience is so easy of application, that all persons almost adopt it. In the first place the abnormal fold frequently gives way of itself in coition. If it resists these efforts, it must be divided either with scissors, or a bistoury. The glans being raised up by the patient or an assistant the surgeon has only to draw down the prepuce, and if he uses scissors cut the frenum as far as possible from before backwards at one stroke. If a bistoury be preferred it is immaterial whether the frenum is transfixed at its base and divided from behind forwards, or whether we simply cut from its free edge backwards towards its adhesions.

In every case it is better to separate it by paring the glans, so that no

protuberances may continue on this part after the recovery. Its destruction by caustics, such as the nitras argenti, as was formerly done and is still among some surgeons, could only be advisable in a patient whose fear of a cutting instrument was excessive. Although dressing of any kind is almost unnecessary, if the individual be irritable or timid, we may cover the little wound with a piece of linen spread with cerate and some lint. Care must be taken not to allow the prepuce to remain too long in one place, if it continues to cover the glans; for thus the parts might become readherent, and the object of the operation would be unattained.

§ 5. *Adhesions of the Prepuce to the Glans.*

The inner surface of the prepuce is sometimes closely adherent to the glans, to a greater or less distance from the orifice. When no constriction accompanies this affection, it does not usually bring with it any remarkable inconvenience; so that it would be imprudent to seek its removal by an operation.

If it however impeded coition, of which examples are cited, and the person was willing to be rid of it at any risk, the following plan is to be adopted for curing it.

After having detached the prepuce below to an extent sufficient to allow of its longitudinal section, the surgeon is to dissect off its whole circumference, little by little, as far as the union of the glans with the body of the penis. To prevent the surface from again coming in contact and adhering as before, the skin must be kept drawn down towards the penis, and the wound be covered with a perforated piece of linen, spread with ointment, and sustained by lint, a compress, and a bandage: in short, every method is to be practised by which the two bleeding surfaces may separately be made to cicatrize. It has been justly observed by J. L. Petit, that the separation of these surfaces is neither easy nor unattended with pain. It would perhaps be best, when they exist on the whole circumference of the glans, to let them alone unless they are complicated with phymosis. On the other hand, when only a simple frenum exists, or that only a portion of the organ is confined by them, the facility of their destruction, and the curvature of the penis during erection which results from them, induced us to separate them. It has been ably shown by M. Langier, that in children in whom phymosis prevents us usually from recognizing their existence, or at least discovering from their situation, amputation of the prepuce or circumcision is the most rational measure to be instituted, if after such an excision the greater part of the glans can remain uncovered.

§ 6. *Destruction of the Prepuce*

Instead of being of too great a length, and adhering to the glans, the prepuce may be too short, or have met with a loss of substance more or less extensive. Celsus who had turned his attention to the mode of remedying this defect in conformation, advises a circular division of the skin at some distance from the glans on the body of the penis, and that then the integuments be drawn forwards and fixed by sutures beyond the free extremity of

the organ. We now know to a certainty, that such an operation is useless, that the cicatrix invariably retracts the skin by degrees, so as to restore the parts to their original condition; but we might probably succeed better by stripping the anterior part of the virile member of its integuments, for an inch or two, so as to be able to bring them over in the form of an artificial sheath, as far in front as the meatus urinarius, just as we raise up on the face the soft parts removed from the neck in the cheiloplastic method of M. Roux; only we should then have to be watchful, lest the adhesions of the new sheath should be prolonged on the surface of the glans. If the prepuce had lost but a small portion of its contour, and the fissure could not be united by the hare-lip operation, we should then have to dissect the two edges of the division more or less off, then to approximate and reunite them afterwards by sutures, after having irritated the edges. As the prepuce is as susceptible of being mended in all ways that can be adapted to nose or face, it is evident that strictly speaking the posdeplastic has as many shades of application as the cheiloplastic.

M. Dieffenback has proved that Sabatier, as well as Petit, was wrong in rejecting as useless or impossible the various methods of restoration applicable to the virile member.

§ 7. *Amputation of the Penis.*

The mobility and extreme distensibility of the envelopes of the penis is such, that tumors, of the prepuce for example, gradually push back the glans and corpora cavernosa, so as to appear to occupy the body of the member itself, when in reality its appendages alone are affected. Hence doubtless arises the error of many older writers, who believed in the reproducibility of the penis, and who thought they had seen it spring forth again after amputation. In fact a considerable extent of parts may be removed, without trenching on the meatus urinarius. The tissues which had been turned back by the tumor, or tumefaction, then lengthen again, and soon resume their primitive dimensions, so as easily to impose on prejudiced minds. Cancer is not the only disease capable of producing a similar illusion; all other degenerations possess this property. It even happens sometimes in cases of acute inflammation. In 1824, there came a robust man, about forty years old, to the Hospital du Perfectionnement, in whom the penis, highly inflamed as high as the pubis and enormously swelled, sphacelated to within two inches of its root, in twenty-four hours. Precautions were adopted for saving what remained of the glans, or corpora cavernosa, in this putrid mass; but they were found entire behind the sphacelus, and with no other lesions than slight excoriations in front.

Amputation of the penis may be total or partial; *total* when the cancer occupies its whole extent, and *partial* in a contrary case. Such cancers as originate in the skin, whether on the prepuce or elsewhere, are a very long time generally in reaching the fibrous envelope or spongy tissue of the organ. The extirpation of them is therefore to be begun in such away as to respect the principal organ, and so as also to sacrifice it if found really morbid in structure. The precept of removing only degenerated tissues, on which so many old authors have insisted, and to which Callisen so frequently recurs when speaking of the operations to be performed on the genital organs, has been too

often forgotten; and we are indebted to M. Lisfranc, for the efforts which he has made in our time to recall it to the attention of surgeons. Besides the peculiarities relating to the envolopes of the penis, its amputation requires that the disposition of its proper constituents be not lost sight of. The fibrous sheath which forms its envelope or shell, and the spongy tissue, whose cells all communicate with one another, dispose it to lengthen or retract immediately after the operation, according as it was previously doubled back or drawn forward by the cancerous tumor. The cavernous arteries, enclosed within it, one on either side, having but little adhesion, project from the surface if the wound of the stump retracts considerably, while if on the contrary it suffers elongation they will appear to be deeply buried in its areola. The urethra, at its under surface and in immediate contact with the skin, has this peculiarity about it; that owing to the junction of its upper and free to its under ide flatwise, it is hidden on the circumference of the wound, immediately after the amputation.

The Operation.—By Ligature. The great dread of hemorrhage induced some of the ancients not to use cutting instruments in the removal of the penis, and to prefer its strangulation by ligature. Ruysch gives an example of a successful application of this method. Heister, Bertrandi, and some other surgeons of the last century did not disdain the employment of the same means.

In performing it, it would always be proper first to introduce a sound into the bladder, in order to prevent closure of the urethra by the ligature. If it is feared that application of the ligature upon the skin would be too painful, there is no objection to following the advice of Sabatier, and making an incision circularly into the integuments, and before putting on the thread: but it is precisely this very incision, as painful as amputation itself, which makes patients afraid of excision and leads them to prefer strangulation.

By Amputation.—The patient must lie horizontally on the edge of the right side of the bed. An assistant takes hold of the root of the organ, and draws the skin more or less towards the pubis, as it appears that the disease has drawn it forwards to a greater or less extent. The surgeon then seizes the tumor covered by a cloth, and holds it firmly in his left hand. With his right hand, armed with a small scalpel or a bistoury, he makes one perpendicular incision from above downwards or from below upwards, through the body of the penis, a little beyond the limits of the disease. A previous division of the skin, a little in advance of the spot where the corpora cavernosa are to be cut through, would scarce lengthen the operation, and would always allow the section of the penis to be even with that in the retracted integuments.

This proceeding, recommended by M. Boyer when the disease extends to the scrotum, seems to me in every case to merit the preference. There are generally six or seven arteries to be tied; viz. the two dorsal, the two cavernosus, the two superficiales perinei, below; then on the lower median line those of the septum. However, the principal ones are the two dorsal and two cavernosa. Should tying them be at all inconvenient, the laxity of the tissue which surrounds the first would render their insulation and torsion extremely easy. It is nearly the same with the second; but it matters not, in such a wound where no immediate union is to be attempted, whether torsion or ligature be adopted.

Modification of M. Barthelemy.—Before proceeding to apply the dressings, a catheter must be passed into the urethra. Some authors having asserted that it was at times difficult to find the orifice of the canal again at the bottom of the wound, a young army surgeon, M. Barthelemy, conceived the idea of introducing the catheter previous to the incision, and cutting it off as well as the penis, so that it might always be found in its natural situation. This plan might either be adopted or not, indifferently, but that it is liable to be attended with the slipping of the cut extremity of the catheter into the bladder, besides rendering by its own section somewhat less easy the amputation of the penis. Moreover, it is clear, that for a man of any anatomical knowledge, this search after the orifice of the urethra never can be very embarrassing. If the skin has been too much crowded backwards it will spontaneously return and cover the wound, and thus offer, possibly, some inconvenience. If on the other hand it has not been sufficiently pressed back, it will be seen to retract towards the pubis, and leave uncovered the fibrous envolope of the corpora cavernosa. As there exists no remedy against this latter inconvenience, while in the former the superfluous integument can always be cut off, it is better perhaps upon the whole to draw the integuments more or less towards the pubis in an amputation of the penis.

If we are compelled by the disease to operate very close to the pelvis, there is still no reason for preferring ligature to excision. The vessels here can present no great difficulty, and the actual or potential cautery, as advised by so many authors, is a last resource fully sufficient to put a stop to any hemorrhage which might occur.

The Dressing.—The catheter once fixed in the urethra, all that is necessary is to apply a perforated Maltese cross, which has in it a hole to allow passage to the sound over the wound. Lint compresses, two small and long compresses, a narrow bandage which keeps them on the remnant of the penis and then goes once or twice round the pelvis, form the whole of the dressing, unless we prefer as after the operation for phymosis to use a suspensory or T bandage, on which is fastened a small bandage or two ends crossed over the bleeding surface. The only object of the catheter in this case being to give exit to the urine without touching the wound and preventing the closure of the urethra, an objection may be made to its use, by stating that far from being injurious the flow of urine over the suppurating surface is often very advantageous. In proof of this it is alleged that urine was once used in facilitating the progress of healing wounds. It has appeared to some, that if expelled by the bladder, this fluid would prove sufficient to impede the closure of the urethra, and that moreover the urethra being lined with a mucous membrane it is unreasonable to fear its obliteration. I saw in 1823, a fact which seems to give strength to this argument. M. Bongon removed the penis of an old man for cancer; a catheter was introduced, and the dressing applied secundum artem. But the man, a maniac and exceedingly intractable, would on no account permit the least apparatus on the wound; and on the second removed it all with the catheter. I reapplied them several times but could never make him understand that they were to be kept on: at length we gave it up, but not without anxiety for the result. However, the wound healed very regularly, and the urethra preserved as large a calibre as could have been wished. The catheter then is not indispensable. As its presence is not

without its inconvenience, we might, even if we did not wholly dispense with it, employ it only during the first few days, so as to prevent any immediate adhesion, and quite towards the end of the case as Le Dran recommends, to prevent secondary stricture.

I cannot close this subject without one observation, which is, that simple though it be, amputation of the penis is nevertheless often followed by the most disastrous consequences. Though the patients who are the subjects of it get well very constantly in fifteen or twenty to thirty days, the larger number are speedily tormented with the most wretched ideas, and fall into melancholy from which nothing can arouse them. Some, to avoid it, fly to self-destruction, while others, at the moment when it is least expected, sink beneath the pressure of the moral affliction into the grave.

SECTION II.

Sexual Organs of the Female.

Abscess, scirrhus, lupus, tumors, and cysts of every species, and the varices seen on the labia majora, require to be treated and operated on according to the same rules as when on any other part of the body, and here required no special mention. Amputation of the clitoris and removal of the nymphæ, are so seldom called for, as to need no separate description.

Art. 1.—*Imperforation of the Vulva.*

The deficiency of an aperture in the vulva is sometimes a congenital defect; at others it is the result of other diseases of the part; again, it is owing to the existence of the hymen, which, instead of a simple valve, is a complete disc; and again may be caused by adhesions contracted between the different parts of the pudenda. It may be that the occlusion of the vagina extends more or less into the pelvis, or even to the cervix uteri itself. In the young girl, before menstruation, the affection in question can in no wise injure her health; and, but for the catamenial periods it would be no otherwise prejudicial to the adult woman than as impediment to coition. It is always judicious, if a surgeon is called early to the case, not to wait until the age of puberty for the performance of the operation; for if the operation be undertaken to remedy difficulties caused by retention of the menstrual fluid, its consequences are usually more serious than when done in infancy. If the vagina be closed by a membrane only, it is sufficient to pass into it the point of a straight bistoury, to incise it freely from before backwards, then across, and to excise the four angles thus formed for its destruction. Afterwards its continuity is to be preserved to a sufficient extent, by the assistance of pledgets of lint or sponges of a teat shape.

If previous to marriage the use of these dilating measures were to be discontinued, there would be incurred the risk of a greater or less retraction or of its entire reclosure; of which the case of a little girl six years old, in whom a colleague of mine only effected a longitudinal incision of the hymen, furnishes me an example. It is perfectly useless first to puncture with a trocar, and then to employ a director on which to guide the bistoury or any other particular instrument. Having effected its perforation, forceps and flat

curved scissors, or a common bistoury even, are sufficient always for removing the portions of the membrane. It is not common to be called on to perform this operation on any female of adult age, unless she have symptoms simulating those of pregnancy, such as enlarged abdomen, &c. owing to the retention within of the menstrual fluid. If the hymen alone obstruct the passage, it will be found arched, tense, and often of a bluish or blackish tint, from the presence of the blood behind it and which is pressing it forwards. In that case it is easier, even, to open than in the preceding one, and any one may do it without danger. Only the sudden evacuation of so vast a quantity of fluid, and the inability of the uterus and other distended organs to retract immediately on themselves, give rise afterwards sometimes to visceral inflammation, and fevers of a bad type. Perhaps it is better to use no pressure or means to hasten its expulsion, and to leave it to the natural contractility of the organs in which it has been so lodged. Thus no vacuum is created in the cavities into which we have opened. It is not possible for air to enter in and stagnate, or react upon the morbific fluid or on the parietes of the cyst, and so produce the mischief of which it is generally accused. Emollient, detergent, or slightly resolvent, or even antiseptic injections are not to be neglected if their use be indicated. As soon as fever, heat, and pain in the bottom of the abdomen ensue, the patient is instantly to be put upon the severest regimen, and antiphlogistically treated with an energy proportioned to the violence of the symptoms.

The operation is naturally rendered more difficult when the obliteration extends into the vagina to any distance from the external orifice; first, because it is impossible to say how far the portion obliterated extends, unless a sort of diaphragm, a transverse perpendicular septum be the obstacle to be destroyed; secondly, and above all, we have to employ instruments between two very important parts—the rectum and the bladder.

Before we begin then, let us be well assured, by introducing a sound into the one, and one or two fingers into the other, that a certain thickness of tissues exists between the two canals, that the uterus is in its normal situation; lastly that the vagina is not wholly obliterated, for if it were it would be almost impossible, and consequently rash, to attempt its artificial re-establishment. Still I believe, that if the life of the patient was threatened by the menstrual accumulation, and that there existed the slightest chance of reaching the uterus, by cutting away between the rectum and bladder, we ought to dismiss every fear, and shrink not before the difficulty of the measure. Suppose it to be thought advisable to resort to the operation. The woman is to be placed in the position as in operating for stone. With the index finger of the left hand in the rectum, an assistant keeping a female catheter in the bladder, the point of which he raises towards the hypogastrium, the surgeon passes into the direction of the vagina either a long narrow bladed bistoury or an armed trocar. The cessation of resistance, freedom of inclination given to the point of the instrument in any direction, are evidences that it has entered the seat of the affection. He then enlarges the wound a little in its whole length by withdrawing the bistoury, whose cutting edge should be drawn backward, forwards, and laterally, if he be sure of not cutting the neighboring organs.

When a trocar has been employed and the canula gives exit to a black and viscid liquid, a director may perhaps be indispensable for enlarging sufficiently

the artificial canal we have made; after which the introduction of the finger will show if the division is large enough, or in what direction its further extension is to be made. Although after such an operation the vagina generally remains pervious, prudence requires that measures be taken to prevent its closing. A tube, either of metal or simply of gumelastic, gradually augmented in size to a certain point would be the best thing, I think, for accomplishing the object, although pledgets of linen or lint, removed every day for the administration of the injections might equally suffice.

Scientific records contain so many cases of successful performance of similar operations, that it is superfluous here to recite one in detail. MM. Ventura, Cabaret, Delpech, Desgranges, Williams, Toulmouche of Rennes, &c., have within a few years completely succeeded in several, and new ones are every day laid before the public.

It must not however be forgotten, than in a case recorded by Morgagni, the woman died in a few days; and that on examination, the urinary bladder was largely laid open, and one of the fallopian tubes burst into the abdomen from dilatation by blood; nor that M. Dupuytren has frequently seen it attended with fearful accidents.

Art. 2.—Puncture of the Uterus.

Closure of the Os Tincæ.—As in the vagina there may never have been any aperture to the neck of the uterus, or it may have become closed by accident, it is equally impossible for the menses to be expelled, and it is therefore liable to the same consequences. The first thing to be done when we have decided that an imperforate uterus really exists and is distended by a fluid, is to seek, by means of the finger, for the neck in the place in which it ought to be situated, and to try, if it be discovered, to overcome the obstacle if possible by the introduction of an ordinary catheter. Otherwise its perforation must be resolved on, which has now been done a great many times with various instruments. Some advise the puncture to be made with a trocar, others that it be made in preference with a straight bistoury covered to a few lines of its point with a strip of linen, &c. The "pharyngotome" even has its admirers. Dance tells us that Barre employed a long canula, armed with a spear-shaped point, which had a fissure on its concavity; so as altogether to bear a strong resemblance to the "arrow headed sound" of Frere Come. On this subject every one is at liberty to please his own taste and adopt the instrument he most admires. A rather long bistoury, concave, and protected by lines, carried in on the index-finger of the left hand, will answer perfectly well for every purpose, while every indication will be equally fulfilled by using the "sonde a dard," the trocar, or the "pharyngotome." Nevertheless, I believe the bistoury and trocar to be the preferable instruments. All that is necessary is, to make an opening into the uterus large enough for the fluid to escape from it, and not to venture too far either in the direction of the bladder or rectum. As in the operation on the vagina, we must here likewise guard against the return of the disease, and do all in our power to prevent the newly established orifice from closing up unless the natural neck of the uterus should be discovered. We must attempt, therefore, to convey into the uterus the end of a gumelastic catheter, through which the fluids

may flow while the wound is kept open. In the operation recently performed with success by M. Herves de Chegoin, he used a trocar, the canula of which permitted him to carry up a bougie, which in its turn conveyed the end of a gumelastic catheter, destined for continuing in the wound, and which was at a later period replaced by a female catheter. This is the wisest plan, and one which all had better follow, be the instrument used a trocar, bistoury, or what it may.

Retroversion.—Another species of disease may also require puncture of the uterus; I mean retroversion of it during pregnancy. When the retroversion is prolonged beyond the third or fourth month, it is sometimes impossible to effect the replacing of the organ, owing to the constant increase of volume of the displaced uterus. The only remedy then, which naturally presents itself to the mind is the removal of what it contains. As that of the child cannot be attempted, we have but to remove the water enclosed in the membranes of the embryo. This very plan, originally advised by Hunter in cases of retroversion, has already been practised many times with success. Twenty years ago a case was related by M. Jaurel of Rouen, another was witnessed at Lyons, under the inspection of MM. Viricel and Bouchet. A third has been more recently recorded by Mr. Baynham, so that it is not as formidable as had been imagined, and is a means of relief worth keeping in reserve.

The woman being placed in the same position as in the preceding case, and kept there by assistants, the surgeon examines on which side of the rectum or vagina the uterus is most distended. One rule which it would be well, I believe, never to infringe, is to begin by doing every thing possible to introduce the instrument into the womb through the opening in the neck. Unless absolutely impossible, puncture by the vagina seems to me less dangerous than that through the rectum, inasmuch as we are not inevitably compelled to perforate the peritoneum, and not as much exposed to come upon the placental mass. Mr. Baynham, however, did it in this latter method, probably because the development of the uterus was in this direction much more decided than in that of the vagina. I must own that the general use of trocars leaves no fistulous openings either in the gut or uterus, and that the wound closes up as soon almost as they are withdrawn. In Dr. Baynham's case only two ounces of fluid escaped by the canula, which was nevertheless sufficient to permit the reduction of the displacement. Abortion ensued at the end of some days. The fœtal envelopes were yet entire, and contained still several ounces of water; the placenta had been pierced as well as the abdomen of the child. In such a case the trocar should be longer than for ordinary paracentesis, and somewhat curved. That contrived by Fleurant for puncturing the bladder through the rectum would do very well. As it is possible to entangle it in the placenta, or that the cord or fœtus may close its orifice, it is well to plunge it pretty deep, and to have a long stylet which may be passed through the tube to clear its upper end, and permit the fluids to flow easily through. After the puncture, we must strive to restore the womb to its natural position. But that abortion is an almost inevitable consequence, the attentions afterwards to be paid would merely be those which enter into the list of what are called for by pregnancy.

Art. 3.—*Prolapsus of the Vagina.*

Instead of merely reducing the protrusion and being content to keep it up by pessaries, M. Dieffenbach conceived the idea of applying to the prolapsus of this organ, the same method of cure which had long before been adopted by M. Dupuytren in that of the rectum. He first effects the return of the part, then to prevent its reprotrusion he excises all around the vulvular orifice, the loose folds on the inner surface of the labia majora, or perineum. All this with a pair of good scissors and forceps is done without any difficulty. The folds thus removed ought to constitute so many radii, having the vagina for their centre, so as that their extremity may extend for an inch or half an inch into it.

The dressing consists in merely washing the little wounds every day; or if we wish to obtain a smooth cicatrice and cause them to suppurate, in the introduction of a pledget of lint rather bulky, whose base will easily furnish a little bundle for each incision.

The object aimed at in this operation is to contract the vagina at its entrance, and the vulva, by giving them a degree of firmness, which they had long before ceased to possess. Although it has not failed to succeed, the plan of Messrs. Heming and Marshall, which consists in the excision of a large elliptical portion of the mucous membrane, and the immediate reunion of the wound by suture would evidently not answer as well. We shall resume the explanation of this subject when we reach the consideration of diseases of the rectum. Should the prolapsus of the vagina be of very old date, and should the tissues have undergone degeneration, or such change as to render its reduction totally impossible, which appears to have been the case in the instance reported by M. Berard, Jr., and the patient at the same time determined upon being relieved from it, we have clearly no other resource to propose than excision. Yet as unhappily it is difficult in these circumstances to say positively that the prolapsus is of the vagina alone, and that the uterus is not comprised in the tumor, in which case the danger attending would be extremely serious, it is as Boyer has said, one which should never hastily be decided on. It should be performed, as will be detailed in speaking of removing the uterus, either by a cutting instrument or by ligature.

Art. 4.—*Reduction of Prolapsed Uterus and Vagina.*

Whether it be the vagina or uterus which presents at the vulva, or the uterus shows itself in the neck, or reversed on itself as the finger of a glove; whether it be prolapsed a third, half, or all its length, or be reversed within the pelvis, this operation, reduction, is always to be employed; replacement always to be practised; and some rules are necessary, of whose importance the surgeon ought not to be unmindful. These displacements are accompanied sometimes with symptoms which should claim for a moment the attention of the practitioner. Some must be encountered before the reduction can be proceeded with, others can scarcely be expected to disappear until after it is effected. Among the first are fever, inflammation, and general reaction; among the second, leucorrhœal discharges, ulcers, and excoriations. Pain in, and engorgement of the tumid organ, are no further

obstacles, than as offering a true mechanical impediment to the restoration of the parts. But for all these the best remedy, the best soother, nay the surest antiphlogistic agent is reduction, when reduction can be accomplished. If the vagina protrude, after its whole surface is enclosed in linen besmeared with cerate, it is to be gently squeezed between the fingers, from the circumference to the centre, before it is pushed from below upwards. An inverted uterus requires a similar application of a piece of linen; but it might be well to apply the tips of the fingers to the most projecting part of the tumor, so as to replace it more surely, and absolutely to carry it up above the superior strait of the pelvis. When simple prolapsus uteri only is present, it is similarly to be wrapped in linen, and as is done with the vagina, we must strive to lessen the base, whilst we at the same time push it back by its summit in the direction of the axes of the pelvis. Suppose there is *retroversion.* It is sometimes necessary to vary the patient's position, who may in the preceding cases remain in the horizontal posture, with the limbs and muscles all relaxed. The first thing to be done, to right the uterus thus retroverted in the pelvis, is to hook with the index and middle fingers of one hand the os tincæ, usually arrested behind or above the pubis. This not answering, a finger or two of the other hand are passed into the rectum, to push up and forward the fundus, whilst we endeavor to draw down the neck at the same time. Failing in these resources, we are advised next to place the woman on her elbows and knees, so that the weight of the abdominal viscera may tend to force the fundus uteri towards the umbilicus, whilst the surgeon is trying to unloose it at the same time. If still foiled, we must imitate Dusaussois, who by the introduction of his whole hand into the rectum vanquished difficulties which until then had been invincible. If the finger had not hold enough upon the neck, it would be proper, as is recommended by M. Bellangen, to introduce into the bladder per urethra the flat sound of Segrot, or a similarly shaped catheter, which might afterwards be used as a hook by turning its concavity backwards.

It is not necessary to say that in simple displacement of the uterus within the pelvis, and in any other case when practicable, we must begin by emptying the bladder by the catheter, nor that it is sometimes easy to embrace the parts to be returned with our fingers, sufficiently firm without using the piece of linen. Repose, a horizontal posture, appropriate injections, venesection, and a general antiphlogistic regimen, are for the most part proper after these operations, as after most others, to moderate the irritation which must have been produced, and to permit the tissues to resume their accustomed functions.

Art. 5.—Pessaries.

The word pessary, which once comprehended every kind of material whatever which was introduced into the vagina to support the uterus, and prevent it from becoming displaced, is now applied only to certain instruments of definite shape. Hence we designate by different epithets, the bladder introduced by Columella into the vagina of cows, a practise since him imitated by some surgeons on the female, in the same manner; the folds of linen and masses of tow, of which Moschion and Absyrtes speak.

Pessary of the Vagina.—Among the instruments now in use among us, are

some whose end is to keep up reduced hernia of the intestines which have descended behind the parietes of the vagina, or to prevent the descent of this part itself. Others again are intended to obviate descent or displacement of the matrix.

The former are of two kinds. The one a long hollow cylinder, about four inches long, called "pessaire en bonden" (bung or stopple shaped), and of diameter sufficient to fill the whole organ. The others, invented by M. Jules Cloquet, are called "elytroid pessaries," and differ from the preceding in being a little flattened, concave on their front part, slightly swelled out at each extremity, and having a very small canal or passage in the centre. The name which the Professor has given them, would be more applicable to the stopple-shaped pessary, since it means merely "of a sheath-like form;" but the name is of little consequence provided the mechanism be well understood.

The same steps are to be taken in the introduction of either instrument. The woman lies upon her back, the thighs moderately flexed, and the legs held a part. The pessary rubbed with cerate is carried by its small extremity to the orifice of the vagina, then introduced from below upwards, and from before backwards, into the cavity of this organ.

The elytroid pessary being larger in one direction than in the other, is to be presented flatwise to the large diameter of the vulva, and so that its posterior angle may first enter the vaginal aperture, and serve to depress the rectum and thickness of the perineum with some strength. The other angle of the same extremity is then depressed gradually, slipping beneath the arch of the pubis; after which no further difficulty is experienced in the introduction of the instrument into the vulvo-uterine passage. When once within it, it is made to experience a rotatory movement, which brings its convexity towards the intestine (rectum,) its concavity forwards, the superior extremity beneath the cervix uteri, and the inferior extremity, which is the largest, above and crosswise between the ossa ischii. The "stopple-shaped" pessary, being merely a tube with very thin sides, is generally introduced more easily: but as it is straight and yeilding, its shape is soon spoiled by the organs, and it is not long before it becomes useless.

Pessary of the Uterus.—Pessaries of the second kind have experienced many more variations in form and materials than those of which I have just spoken. The ancients constructed them from an oval or elliptical plate of wood or cork, which was covered with a coat of wax of unequal thickness; besides which they were of gold, silver, copper, lead, and even tin, of every shape. Those called "ring-shaped" (en gimblette) were either entirely circular or slightly curved before and behind in the form of a figure of 8, or else depressed at the four extremities of their two principal diameters together; or simply ellipsoid, flat, and perforated in the centre. In England, a globe-shaped pessary is employed, sometimes hollow, sometimes solid, pierced in the centre or not, and the same method is adopted in America. Cork and wax have been long entirely rejected as too easily altered by the pressure of the parts, and not sufficiently supple. The same fault may be found with ebony, ivory, gold, silver, singly employed, especially as we possess materials so much more elastic, lighter, and less changeable. They are now made almost altogether of elastic gum; though sometimes it is supported on linen, horse hair, felt, woollen, silk, &c.

In order to have them as light as possible, M. Rondet, who employs a well tempered steel ring covered with horse hair, and real caoutchouc, has contrived others of the same substance, the circle of which is hollow and filled with air. As by the use of this composition pessaries continue elastic, and rather flexible, causing but little irritation of the parts, and are much less easily altered in shape than most others, they justly deserve the preference which they usually receive. Dr. Physick however still continues to use gold and silver pessaries, which are globular, as in the times of Clark and Denman, and consist of two capsules soldered together at their base.

Those pessaries which are rather broader transversly than from before backwards, are in the whole most easy of introduction, and least apt to interfere with the functions of the bladder and rectum. They are more easily inserted even than the vaginal pessaries. All that is to be done is to carry them into this passage with the same precautions which are indicated above. The finger placed within the ring, or some point of their circumference, permits us to give them always a suitable situation; that is, to effect a see-saw motion which brings them horizontally within the pelvis, one edge before, the other behind, and the extremities towards the ischii, so that the os tincæ may rest on the superior concavity which extends through all their thickness. Women who have lascerations of the perineum, or in whom the vulvular orifice of the vagina is very large, derive scarcely any benefit at all from the "pessaire en gimblette" or from the ball-shaped, which they can seldom retain. Surgeons were therefore early obliged to resort to other more perfect instruments to supersede them. The species described by Bauhin as "en bilboquet" (cup and ball), are made of a ring of ivory or wood, which is supported by three branches ending in a long stem, several inches in length, and having three or four holes at its free extremity. The cup of this instrument, intended for the reception of the neck of the uterus, is deep enough to allow an easy escape, between the three branches of the stem, for the menses and other fluids which come from the uterine cavity. The ribands which go from the lower apertures of the stem are to be attached to a girdle, which the woman is not to leave off.

Desormeaux having observed that, notwithstanding the grooves between the cup of the pessary and its root, fluids sometimes accumulated about the neck, and these acquired irritating properties, contrived to convert the stem of the instrument into a true canal, and to give the cup the shape of a very small and shallow funnel; but in spite of his precautions the fluids still collect sometimes between the uterine orifice and the instrument which supports it, so that in fact it is of no great importance to prefer this pessary to the old one. If as some practitioners, Desormeaux among others, insist, we did but fix the olive-shaped extremity above the coccyx within the vagina, rather than tie it with ribands to a bandage around the body, there would be so much risk of perforating the rectum that I could not recommend its adoption; even though the instrument should be fitted with the peculiar spring within the pivot recommended by M. Recamier. Some, with the idea of guarding against the vacillation and unsteadiness to which the instrument as the woman walks is perpetually subjected, have advised the use of pessaries which have at the lower end a plate about four inches long, concave above, and pierced with a large hole behind, opposite the anus, and with two slits in front so

that strings attached to the four angles of this plate allowed them to embrace the whole extent of the perineum closely from before backwards, and to keep the pessary nearly immovable in the direction which has been given to it.

Saviard, discontented with the pessaries in use until his time, invented a little apparatus of extreme ingenuity, for supporting the uterus, consisting of a curved spring fixed by one extremity on the hypogastrium, whilst the other entered the vagina to compress a tampon conveniently adapted to it. That proposed by M. Villerme is upon a similar principle. Its stem represents a large arch, the concavity of which, when it is introduced, ought to embrace the anterior half of the pelvis. It is a sort of hook, the tail of which fastened upon the hypogastrium permits the head in the vagina to sustain or support the whole gestative organ. M. Deleau has just brought forward another, which holds a sort of middle place between the "round" and "cup and ball" pessary. It consists of an elastic spring surrounded with gumelastic, twisted into spiral curves of which the apex or first ring is fastened, and the basis or last ring hangs loose, to be tightened or widened according to need. When it is wished to introduce it, the circle is sufficiently narrowed, and a sort of piston is fastened to its head. Left in the vagina point uppermost, its elasticity readily adapts itself to the dimensions of the part, without any risk of being displaced. In the collection of theses by Haller, Preuner describes one similar in almost every respect, and I much fear that its advantages are more apparent than real. Whatever be the pessary employed, care must be taken to withdraw and clear it from time to time. Otherwise it might become covered with calcareous matter, create ulceration of the vagina, and give rise to serious consequences, of which many instances are recorded. Women soon learn to perform this little operation for themselves, and to have no need of any one's assistance to replace it at proper seasons. When first introduced it is useful to keep the patient for some days in bed: otherwise she would be exposed to more or less suffering from a sense of weight about the fundament, which is apt to excite symptoms of irritation, much less liable to happen when time has been given to the parts to become accustomed to the foreign body, and as it were to mould themselves upon it.

One question here presents itself, which must be answered; are pessaries really advantageous? no doubt they do give a great deal of trouble and inconvenience, and create many accidents. Many women undoubtedly cannot endure them at all.

The pressure they cause upon the bladder and rectum, necessarily is an obstacle to the function of these organs. The neck of the uterus more or less irritated by such a body, enters and is strictured within the aperture of the pessary which in turn is too apt to end by excoriating and perforating the walls of the vagina, if not of the rectum, or bladder of urine. If instead of the round pessary the cup and ball instrument be preferred, do what you will with it, it will lean more in one direction than in another, and will at length depress the os tincæ as well as the vagina. The round one almost always turns over backward or forward, and equally ill supports the neck of the uterus. As to the "stopple-shaped" pessary, owing to the thinness and almost cutting character of the openings at each extremity, it also easily injures the parts on which they are applied. The "elytroid" pessary yet

remains, which as it is moulded on the canal, and fills it with some accuracy, is less liable to be displaced, preserves the parts in a natural position with greater certainty, requires fewer precautions for its proper management, and hence offers fewer objections than any other. But as it is a larger mass and fills the whole organ, many women find it in this respect very inconvenient. Still it is the one which appears to me to deserve the preference, and that which I employ when I cannot dispense with a pessary of some kind. Since these instruments are so far from being inoffensive why continue to use them? Certainly in many cases in which they are directed they ought to be proscribed; for example, after simple prolapsus, after the reduction of a retroversion, the introduction of oval pledgets of lint, or of little bags, rendered astringent by being steeped in wine in which rose-leaves, oxycrate, (vinegar and water) have been boiled; of decoctions of kino; of solutions of alumen sulph. introduced and renewed every day within the vagina for a long time, would be better than the use of pessaries. Fine pieces of sponge, or of linen, arranged and sustained as is done by women during their catemenial periods, would also supersede them very advantageously, if a mechanical means were absolutely necessary to keep up the uterus.

Thirdly, if the descent of the organ were evidently brought about by the undue size of the vulva, the excision of its surrounding cutaneous folds, though painful, would deserve I think the preference, as likely not only to produce a permanent cure but also to permit the continuation of conjugal enjoyment.

Art. 6.—*Foreign bodies.*

1. *In the Vagina.*—Those which we are occasionally called on to remove from this part of the body are usually pessaries, or remains of pessaries more or less changed in their nature. However, other substances also have been observed. M. Dupuytren detected in it a pomatum pot, the bowl of which was turned downwards. It is easy to fancy the variety in form and nature which such substances as are introduced into the part by accident or design on the part of the woman will present, and the character of the affection to which they give origin. Pessaries which had been lost for ten, fifteen, and even twenty and forty years, have been known to become encrusted with calcereous matter, corroded, even perforated by fungous growths, to produce pain, inflammation, and the most fearful train of symptoms. In a woman cured by M. J. Cloquet, the changes in the vagina was such as that until then it had been considered as cancer. Usually they ulcerate and perforate either the bladder or rectum, and sometimes both together. A woman broke the stem of a "cup and ball" pessary in attempting to withdraw it, and at length forgot the ring in the vagina. After a lapse of many years, she became afflicted with symptoms which induced her to seek the extraction of the foreign body. M. Dupuytren then ascertained that it projected both into the rectum and bladder. Another fact still more curious has also been published by M. Berard of which I was myself a witness. The patient, an aged woman, had not thought of her pessary for five and twenty years since she had broken the stem. By the catheter it could be felt naked in the bladder, and very distinctly in the rectum with the finger. The vagina below was nearly obliterated and consisted only

of a cul-de-sac, having a slight opening at its upper part. In the case which was communicated by M. Larrouche to M. Jules Cloquet, the pessary (which had a stem) had entered the rectum, where its cup had become the centre of a stercoral calculus, while the extremity of the stem had done the same in the bladder.

The operation called for under such circumstances must be as various as the cases in which they are required, and cannot be restricted to the rules of a particular description. If the pessary be unadherent, and we wish only to put an end to the irritation which it causes, the index finger passed within its circumference or on its edge will suffice frequently for its extraction. If it be otherwise, a long polypus forceps might advantageously take the place of the finger, or a soft blunt hook, carried in and protected by the index finger of the left hand, may be tried. When it enters the rectum and cannot be got out by the vagina it is to be drawn forth by similar means through the anus. If its size offers an obstacle to success in this way, its division into pieces may become necessary. If it be of wood, ivory, or any fragile material, this is easily enough done by a strong and solid pair of pincers or forceps. We cannot say so much for metallic pessaries. Here we must trust to the feeble aid of a file or small saw carried up the rectum, and by a proper canula prevented from injuring it; whilst with forceps the foreign body is to be kept as motionless as possible. M. Dupuytren succeeded in his object in the case just related by means of a saw. In the patient whose case I witnessed at La Pitie, M. Lisfranc began by making an incision in front of the anus, through a portion of the perineum, in order to make himself more room. He then seized the pessary without any very great difficulty, and promptly withdrew it with the assistance of forceps held in the right hand, while the middle and index fingers of the left hand directed their motions at the bottom of the parts. The position of the woman, and the precautions necessary before and after the operation, are the same as those directed in the other proceedings on which we have dilated in the preceding sections. If a glass, a vessel either of wood or earthenware, be the cause of difficulty, it must, when every effort to place it in a favorable direction and so remove it entire has been tried, be broken in pieces and removed piece-meal. The judgment of the surgeon must moreover, make up for the silence to which books are necessarily reduced on such subjects. Unless the rectum or bladder of urine have been opened, the results of the operation are very simple. It is likewise remarkable that the fistula in them are not long in closing considerably, and even end by healing up entirely.

Art. 7.—Foreign Bodies in the Uterus.

The cavity of the uterus sometimes contains free and inorganic masses, which have been described by Louis, under the name of *calculi of the uterus.* These calculi, which are thought by MM. Roux and Dupuytren to be altered states of fibrous tumors, have often been observed. I have myself seen them both in the cavity of the organ and in its walls. Whether the opinion of MM. Roux and Dupuytren be or be not well founded, it is at least certain that in a good many of the bodies of which I speak, are either simple, earthy concretions, or the detritus of pregnancy. One which I had an opportunity of

examining, was as large as an egg, round and knobbed, contained in many points of its circumference hairs, and some portions of osseous cutaneous tissues, whilst its outer surface was but a calcareous crust. They have awakened naturally the anxiety of surgeons, as capable of leading to bad consequences. Hippocrates mentions an old woman who had taken one from the vagina of a servant. Ætius advises that they should be made to pass the neck by pushing them downwards, with two fingers in the rectum and the other hand placed on the hypogastrium; and then be sought for with forceps. He likewise practised dilatation and incision of the cervix. Louis recommends that cutting scissors be introduced into the os tincæ, to open its orifice from within outwards, and thus favor the exit of the calculus. To this there is but one objection; viz. that we never know that the woman's symptoms indicate this more than any other uterine affection. As it is strictly impossible to be certain on this head, no one at this day would dare to attempt the operation of Ætius, still less of Louis, unless the stone were more or less engaged in the cervix uteri and could then be distinctly felt.

Art. 8.—*Polypi of the Uterus.*

No method of treatment has been proposed for the cure of polypi in general, and particularly for that of nasal polypi, which has not been applied to this disease when existing in the uterus. The latter species, from being situated in a more accessible organ, one more easily explored, and more readily made to change its situation, have not excited the ingenuity and genius of surgeons on this account as much as the others. Thus cauterization, of which Celsus seems to speak, and which is alluded to by Verduc, Volter, &c.; scarification; the use of dessicative remedies contained in the list of Ætius, and the book of Moschion have long been abandoned. On the other hand, simply tearing them out, or this combined with twisting or torsion, is applicable only in a small number of cases. The reason why it appears to Sabatier and other modern authors that the treatment of this disease was much neglected by the ancients, is, that it was known in medical books until a still recent period under a great variety of different names. Philoteus, for instance, evidently confounded them with cancer, and Moschion with varix of the uterus. There can be no doubt on the subject, when the mysterious Aspasia describes them as "hemorrhoidal-tumors," which spring "sometimes from the neck, sometimes from the fundus uteri," and "seldom" from the external genital organs; tumors which may be fearlessly excised when white and hard, which "must be tied," when they are easily excited to hemorrhage, and which sometimes resist every means to remove them.

I understand the relative value of the various methods of operating for uterine polypi; and to reconcile the conflicting statements of writers on the subject, a few words as to their nature and origin become indispensable. It is indisputable that tumors arise in the uterus perfectly different in character from one another. The little polypus, noticed by Z. Lusitanus, the removal of which was attended with so abundant a hemorrhage, may be compared to the vascular polypus, so tenacious of vitality, seen soften in the nasal fossa. M. Berard has seen in the neck of the uterus, soft, and nearly wholly mucous polypi, much resembling those of the nose. I have thrice seen in the uteri of

women, who were subjects for dissection in the practical school of anatomy, tubercles of various size, containing small vessels which were continuous with the tissues of the organ and yet not pedunculated. MM. Dance, Berard, and Cruveilhier, have, with MM. Mayer and Meisner, seen others which appeared to be the result of true partial hypertrophy, either of the body or cervix of the uterus; that is to say, they were continuous with the fibres of the viscus without any line of separation, and their structure was in no respect different from that of the viscus itself. In 1825 I published a case of this kind, and preserved the pathological specimen in alcohol.

Others again, which are likewise continuous with the tissue of the uterus, are evidently degenerations or morbid alterations of its structure. They are hard, grey, and elastic; when cut into their aspect is that of a lard-like or semi-cartilagenous substance, homogeneous, white, wholly destitute of vessels, and in which it is impossible to detect the least vestige of fibres. I had occasion, in the beginning of this year, to remove one which possessed these characters in a striking degree. The most numerous by far, are those, nevertheless, which since the investigations of Bayle, Roux, and Dupuytren, go by the name of "fibrous bodies," and are primarily developed between the tissues in the thickness of the uterus itself. I am induced from some observation, to think that they often result from an effusion of blood, a fibrinous concretion, which becoming organized by degrees continues to sustain its vitality, and to grow by imbibition in the midst of the surrounding parts of a greyish or whitish color, like the preceding species, and always appearing to be composed of fibres which interlace in different directions: they contain no vessels, and are covered by a sheath from the uterus, thin in proportion to the magnitude of the tumor, and which becomes more distinct as we approach their peduncle.

This brief detail sufficiently shows that hemorrhage is to be apprehended only after the removal of uterine polypi of the first varieties; and that that of the two latter species can never occasion it. Now, as these are much more frequently occurring it follows, *cæteris paribus*, that excision must be much less dangerous than it was for a long time, and by some is still thought to be.

We must also be heedful before proceeding to an operation, that we have not confounded the polypus with inversion or prolapsus of the uterus or vagina, or with that elongation of the neck from hypertrophy spoken of by Lallement and Bichat, or with cancer, &c. It is enough to point out the possibility of these mistakes to prevent the practitioner from falling into them; although they have often been made, as well as errors of the opposite kind. There is yet another which I never saw mentioned, and into which I was myself very near getting. A woman, thirty-two years of age, came under my care at the Hospital St. Antoine, in 1828, during my attendance there. She had from time to time for a month past experienced slight losses of blood. On examination I discovered a mass as large as a small egg, a little swelled, of firm consistence, and which extended by a very distinct peduncle to the upper part of the neck. I took it for a polypus. The patient was placed in a bath, and for three days prepared for the operation. When I carried my finger into the parts I again encountered the mass I had before felt, but as I tried to follow up the peduncle, it fell into the vagina and I removed it. It was a fibrinous concretion, a mere clot of hardened blood! Polypi may, in turn, be mistaken

for tumors of another kind. In 1823, MM. Richerand and Jules Cloquet removed one as large as a child's head, which they took from the vulva of a woman where it had hung for many years, and supposed they had removed the uterus. The mass, which was opened in the presence of M. Richerand, had a cavity in the centre, and almost every other character of the uterus; and it was supposed to be an unanswerable demonstration of the possibility of removing that organ.

The patient died. When examined, the uterus was entire in its natural position; an enormous polypus only had been removed!

A woman from the country, who came to the Hospital Perfectionnement, in 1824, to have what she called her "falling down" reduced, had in the vulva a conical tumor, with a small transverse slit across its summit, which she had for a long time kept up by a pessary, and which I easily returned into the vagina, and maintained there by a cup and ball pessary. After her return home some days, she was attacked with abdominal pain and returned to the hospital, where she died next day of peritonitis. The tumor which I had reduced was a polypus, fastened to the fundus uteri by a peduncle as thick as my finger!

1*st Method.—Tearing forth.* When fibrous polypi have effected an exit through the neck of the uterus, they undergo a kind of strangulation, which is sometimes sufficient to effect their separation. Two examples seen by Mercadier and Louis, have been reported by Levret. Similar ones had been related by Mauriceau, Ruysch, Hoffmann, and before them by Rhodion and M. Donatus, Vacoussin, Gooch, M. Hue, and more recently by M. Herves de Chegoin, have also published cases. It has happened to me to see one yield abruptly to the slight efforts I made to bring it towards the vulva to excise it. Latterly Mr. Griffith has announced a like result by the use of ergot. Doubtless this falling of the polypi led to the idea of the plan of tearing them out as practised by Dionis, Juncker, Heister, and since formally proposed by Lapeyronie, and afterwards by Boudou. These authors advise, at the same time, torsion of the peduncle, whether as a guard against hemorrhage or to break it more easily. Torsion, however, added to mere traction, may become dangerous by extending into the tissues of the uterus. In 1753, Hevin sustained a thesis in the schools of surgery, in which he maintained that by grasping the origin of the tumor at its upper part, and turning it in itself with forceps, this danger would no longer be incurred.

To perform this operation by laceration, we are to seize the body of the polypus with the forceps invented by Musieux, or the ordinary kind, or even with the fingers if small, or else with straight or curved forceps. We then exert methodical traction, either simple or combined with slight rotary movement, until it be drawn forth.

It is only at this precise period that the precautionary advice given by Hevin can be followed; and the torsion, really such, advised by Boudou be practised without inconvenience, in cases of thick foot stalks; otherwise it can have no good end, for if we are then afraid of immediate excision nothing is easier than to apply a ligature on the narrowest spot of the morbid mass and cut below it. M. Recamier, who thinks that these bodies can be destroyed, not only by extraction but by a kind of trituration or bruising, has just published two remarkable cases in support of his assertion. In one, the

polypus as large as the great toe, projected into the vagina from its origin in the upper part of the cervix uteri. By strong pressure with the index finger of the right hand, he contrived to divide it, reduce it to a pulp, and extract it in less than two minutes. In the other case, having resisted ligature and extraction, it was futilously broken up by hooked forceps and the fingers into a sort of flux, the filaments of which slipped ceaselessly through the teeth of the instrument.

Method 2d.—Ligature. This treatment of uterine polypus is much more ancient than Levret has supposed. It is evident that Ætius, Moschion, and before them Philoteus, were acquainted with it, and that it was frequently resorted to after their time. It is, however, but just to Levret to confess, that it is to him we owe its adoption into the practice of modern times, by showing its applicability not only to tumors which protrude from the vulva, but to those also which are attached highest in the genital cavity.

To effect it, many instruments have been invented. All those which are employed for tying nasal polypi, may he used for this purpose. The two tubes fastened together like forceps, the principal of which is so highly praised by Levret; those constructed by Theden on nearly the same principle and plan; the instrument of Lecat, and that of Herbiniaux, are now abandoned. Neither has the use of the double canula of the first of these authors been retained in practice. They have been forgotten since the separated hollow tubes constructed by Desault, and the catheters of Niessen; and every thing leads to the belief that the alterations proposed by Clark, Laugier, Lœffler, Cullerier, and a crowd of others mentioned in the Treatise written by M. Meisner, will speedily undergo a similar fate.

Method of Operating.—The instruments which have been judged advisable being at hand, the operation is conducted in the following way. The surgeon having reconnoitered the position of the polypus, and calculated the size of its peduncle, arranges the ligature which he means to employ. This, which in the time of Levret was of fine silver, is now more generally made of silk or thread of the utmost tenacity. If the two canula of Levret are selected, it is so placed as to make a handle on one side, and to be fixed on the other side upon a ring which is placed outside of the mouth or aperture in each. One or two fingers of the left hand, carried as high up as possible, convey the whole to the pedicle of the polypus. The surgeon then takes one canula in each hand; holds firmly fixed in one spot that which has attached to its base the ligature, with the other encircles the base of the peduncle until he can cross them; twists them; then turns them together on their axis; withdraws them; then includes the two conjoined extremities of the ligature in another tube called a "serre-nœud" (knot-tightener), which allows of his strangulating the tissues with all necessary strength.

The instruments of M. Desault, differ from those of M. Levret in having two free and separate "porte-nœuds" like those of David, and in one of them a sort of forceps is enclosed, which when shut ends in a little ring at the top. One half of the ligature is first passed into the plain canula, and fixed upon the ring below; the other is then laid hold of by the forceps, which is closed and drawn back into its sheath, and which is notched at its inferior extremity for the reception of the end of the second thread. This apparatus is carried, like the former, by the fingers to the spot which offers the least

resistance. When he arrives at the peduncle, the operator with his left hand keeps the plain canula motionless, with the right seizes that armed with the forceps, passes over with it the whole circumference of the tumor, and brings it back to the level of the other, so that the ligature forms a complete circle around the pedicle to be strictured. The split shank pushed into the canula, opens by its own spring, loosens the string, and may be removed without its being displaced. The extremities of the ligature being then united so as to form but once piece, are then brought through an opening in a last piece of metal, some inches long, the head of which has a hole in it, and is bent at nearly a right angle on the body of the instrument. This "serre-nœud" allows the elevation of the constriction to any degree of severity which may be desired, and of its augmentation or diminution as may be seen fit. It is finally to be fixed, after having been surrounded by linen, to one side of the vulva by a small riband.

The apparatus of M. Neissen consists of two long silver canula, curved, but sufficiently flexible to be straightened or bent, which serve to convey the ligature. When they have arrived around the tumor they are both included in a third canula, divided by a middle septum into two tubes, and only one or two inches in length. This, which seems but a fragment of the double tubed instrument of Levret, is carried up from below with the fingers as far as possible, and still higher by means of a hooked sound. It is intended to increase the strangulation of the peduncle of the tumor more and more by compelling the upper extremities of the two first canula to approach one another strongly, without departing from their parallel direction.

At first sight no very great advantange seems to arise from these instruments over those employed by the French practitioners. The canula of the German author, being no more than those of Levret a little increased in length and curve, perhaps are better adapted for penetrating a great depth; but I think the double tube intended to approximate them infinitely less calculated for the object than the "serre-nœud" of Desault. If this latter portion of the apparatus be thought to be in need of some alteration, the fillet, of which M. Mayor has made so happy an application within the last few years, would here, better than in the nose, deserve a justifiable preference. If, in strangulating the polypus, we possessed neither the mechanical cylinder of this author, nor the little instrument of the same kind invented by Levannier of Cherbourg, we might simply attach the two ends of the ligature to a piece of linen, or other solid body, and tighten them on that. The "serre-nœud brise," which Bichat has endeavored to substitute for the forceps canula of Desault, fulfilling very seldom the intention of its inventor, it does not seem to me to deserve more than this notice. Nor do I think the speculum of M. Guillon, modified by M. P. Dubois so as to hold a ligature, of such a nature as to supersede the very simple and ingenious contrivance of the veteran surgeon to the Hotel Dieu.

When the ligature has been well applied, circulation and vitality are quickly interrupted in every part of the tumor beneath it. Whilst this mass is mortifying and being decomposed the ligature is gradually cutting through its peduncle. It is easy to comprehend how this will be accomplished with greater or less rapidity, according to the power of the constriction employed, and to the density, resistance, and bulk of the tissues which it encircles.

Did the dimensions of the foot-stalk not exceed an inch in thickness, a single riband drawn tight upon it would suffice to cut it through in some days. Beyond this thickness it has been thought it would be better to transfix it with a needle and double ligature, so as to strangulate each half separately. To this proceeding two objections may be made: 1st, polypi, which can be drawn down into the vagina, the only ones capable of this transfixion, seldom have root enough to demand such a precaution: 2d, those whose foot-stalks are more voluminous, as to allow their being drawn down or not, are all either fibrous bodies which ought to be cut off by the knife, or morbid growths which should be let alone altogether.

Between simple ligature or excision then our choice should lie. Among the instruments for applying ligatures, that which M. Mayor has recently proposed and figured in his treatise on "ligature in the mass," seems to me especially worthy of a trial. It is composed of two elastic stems of steel or whalebone, unless there were time to procure metallic ones, ending superiorly by crab-claws. The ligature is placed in them just as in the instrument of Desault, and is to be carried round the polypus with the same precautions. To throw it off, we have only to pull rather strongly on the conducting instrument, as soon as the knot-tightener arrives at the penduncle to be incarcerated. In the double tube of Levret the two portions of the string come together too near the polypus to render their passage easy when we wish to increase the constriction. It is so indeed with all "serre-nœuds," as I have again recently experienced. M. G. Pelletan, who had like others suffered from the inconvenience, had constructed by M. Sirhenry a very ingenious little apparatus to do it away. The two branches of his knot-press which terminate its deep end, separate slightly outwards, like a fork, for some lines superiorly, and are applied by their sinus to the root of the polypus, and scarcely bend the ligature, while they in some measure continue its circle. A spring, a kind of steel fillet, curved in several direction to increase its elasticity, placed at the free extremity of the instrument, receives the other end of the string and constantly increases its tightness. This *elastic part* can be adapted to any other instrument, and among others that of M. Mayor. The forking out of the knot-press would only give trouble if it were to be turned on its axis to twist the thread.

Remarks.—Before we strangulate a polypus which is dependant without, it behooves us to observe that its peduncle may proceed from the fundus of the inverted uterus, and that in that case it would be dangerous to place the ligature too high up on the tumor. Decomposition of a polypus within the sexual organs often gives rise to accidents which we would fain avoid. The disgusting smell too which attends it is so extremely nauseous to the patient and those about her. When the polypus is large, and the weather warm, it really becomes perfectly insupportable. The putrifying mass, moreover, may irritate the vulva and vagina, and if it be reabsorbed may give rise to constitutional infection, and a fever of a very bad type.

If the tumor cannot be drawn out we must resort, to overcome these inconveniences, to the ordinary methods of cleanliness, simple injections of mallow tea, or barley water sweetened with honey, of decoctions of kino, or better still of the alkaline chlorides in solution. But when the first stalk is naturally low down, and may be brought lower still by moderate traction with but little pain,

it is more expeditious, and certainly less dangerous, to cut off the whole mass below a ligature than to leave it to come off of itself. It is not worth while to discuss the question, which has been done by many authors of imposing reputation, whether when the ligature is applied to the parts before our eyes, it is better to practice excision immediately than to wait for the mortification produced by the ligature. By the former method the patient is at once relieved, and that without any reasonable apprehension as to hemorrhage; by the second we do not guard against this unpleasant occurrence, and as it exposes her to risk of the consequences without corresponding advantages on this head, I think it ought to be abandoned entirely. Levret maintained that after ligature mortification progressed to the junction of the polypus and matrix, notwithstanding the constriction have been performed below this point; and that once strangulated, these tumors gradually separate always in the same spot, nearly as does the umbilical cord at birth whatever be the spot where the string had been placed. To M. Boyer, this seems a dangerous doctrine. In fact were it false it might lead to vexatious practical results. If it be adopted it would matter little whether the string be placed exactly on the upper part of the pedicle, or somewhat below it. As it is usually more easy to place a ligature low down than high up, as likewise some may dread including some part of the uterus tissue in it by elevating it much, the ligature would often be so placed as to leave a part of the polypus still within the organ. On the other hand, the statement of M. Boyer is correct, that as life ceases in the tumor only as far as the constricting agent, the ligature ought if we would guard against a return of the disease, to be placed as high up as possible on the morbid growth. The opinion of Levret is based upon facts. A distinguished surgeon in one of the departments, M. Genson at Lyons, has quite recently supported it by a statement of his observations. It asserts neither any thing contrary to what is known of the laws of the organism, nor which cannot be said of the separation of the umbilical cord. It is essential that this point be well understood—mucous polypi, and those polypi to which many vessels are distributed, and which are evidently continuous with the tissues of the uterus, do not probably make in favor of the theory of Levret, which seems to me applicable only to those which are really foreign bodies within the cavity of the organs, and to those polypi which are purely lardaceous or fibrous, and destitute of any appreciable vascular supply.

3*d*. *Excision.*—More daring than were surgeons in the last century, the ancients often performed exsection of genital polypi. Philoteus, Ætius, Moschion, and others, evidently described this method when they advise that varicose excrescences, and hemorrhoidal tumors of the uterus should be removed by the knife. Aquapendente, who was much lauded, used for its accomplishment forceps with a scissors-shaped extremity, which saved him the labor of first drawing out the polypus. Although here and there some authors have called attention to this practice; though Tulpius, Waters, and Fronton quoted by Levret, each record an instance in its favor, it has not yet triumphed over all the prejudice which theoretical speculation so long ago created against it. M. Boyer, who reports that he has once successfully tried it, and seems not far from giving it a preference, dares not however to propose it formally for general adoption. It is condemned as being more likely

than any other to give rise to hemorrhage; to dangerous wounds of the rectum, bladder, vagina, and even of the uterus, and also as being much less easy than that by ligature. The wound which it must produce, has in its turn frightened many surgeons, who have been afraid of inflammation in the gestative organ, or of suppuration and an ulcer which it would be difficult to heal.

All the research, and all the dissection which I have made, along with those recently performed by M. Hervez de Chegoin, have convinced me that all polypi which are really fibrous bodies, may be excised from the uterus without the slightest inconvenience. They never adhere to the organ by a peduncle of any size, nor are supplied with any vessels. The layer of uterus which covers them as a sort of hood is usually very thin, and constantly reduced to a mere shell which has only to be incised to allow their enucleation, or turning out, to be easily accomplished with the fingers or the handle of a scalpel, as if it were a leipoma or a subcutaneous cyst. As to the homogeneous, hard, and greyish bodies, like the preceding, which are continuous with the uterus, the section of their pedicle can never bring about any alarming loss of blood, if I can judge by those which I have seen in the dead, and removed from the living body.

Thirdly, I do not see either how the fibrous masses which originate in *partial hypertrophy* of the uterus need justify the least fears on this subject. It is rare for entire excision of the neck of the uterus to be attended with abundant hemorrhage, and it is not easy to believe than removal with a cutting instrument of the little, mucous, soft tumors described by M. Berard, or of any other polypus production capable of being removed by ligature, should really be rendered dangerous from such an occurrence. We have then, lastly, only the reddish, bleeding fungi, sometimes painful and rarely pedunculated, of which we before spoke, which can be unfit for the operation of excision: but to them ligature offers no better a resource: for we are compelled to enrol them in the list of those distressing affections which baffle our art, and to which with the greatest propriety the term "noli me tangere" may be applied. For twenty years past M. Dupuytren has cut away every uterine polypus which he has been called on to treat, and once only has the hemorrhage appeared to him to demand any particular attention. Numerous facts equally conclusive have been cited by M. Hervez de Chegoin. Operations, equally successful, of this kind have been related by M. Villeneuve, M. Lejeune, and a host of other surgeons. In Germany, MM. De Siebold and Mayor have published a treatise to prove that excision, long practised by them in the Hospital at Vienna, has been attended with remarkable success. May I be permitted to add, that of eight operations for polypus with a cutting instrument, performed by myself, not one has been followed by the least hemorrhage.

The Method of Operation.—The instruments, &c., necessary for this operation, are the long forceps of Museux, a common bistoury or scalpel, some lint, and some astringent preparation in case of need, and some linen, as for other bloody operations. If the tumor be very large, a few more may however become necessary; such, for example, as forceps, sharp hooks, or what I have sometimes used, long, strong double hooks slightly curved, to meet the shape of the parts. In ordinary cases the right hand passes the forceps closed into the vagina, and they are not opened except to seize hold of the tumor; while the left hand, while it protects the parts, directs the insertion of the hooks. We are then to draw down the morbid mass, by very moderate traction, by

degrees; and if the mobility of the uterus permits us to get the pedicle to the vulva, the labia are to be separated with great care by an assistant, and the section is made with every facility by means of some cutting instrument or other. When on the contrary the polypus offers much resistance, we must not permit it to reascend, but with the point of a straight bistoury, the blade of which has been previously wound round with a strip of bandage, the surgeon must proceed to divide it at its narrowest part, always following the knife with the fingers of the left hand, which continue in the vagina. I had occasion to remove from a young lady, living in the street of the "Petit Carreau," a polypus as large as a turkey egg, which was inserted into the inner surface of the neck of the uterus, and which after it was once engaged in the vulva, seemed not willing to descend any lower. Whilst M. Cottereau, the physician to the patient, retained it in the pelvic strait, I passed up my left index and middle fingers towards the os tincæ; then slipped a covered bistoury, with my right hand between the polypus and my fingers, to the top of the vagina, with which I easily detached the tumor. Not a drop of blood escaped, and the the lady, after the third day, might have resumed her accustomed occupations. An almost similar case has just occurred in my department at La Pitie.

If from the size of the polypus this cannot be done, we must use a bistoury curved a little on its flat side, or else scissors of the same form. In those cases where it would seem dangerous to make traction upon the uterus, we should find an invaluable auxiliary in the species of forceps which is strongly curved at one end, somewhat scolloped, and made to cut like the forceps of J. Fabricius, of which we are told by M. Lauth, that M. Lobstein has often made use. With the same view, M. Mayor contrived a long, and very strong scissors, curved like the letter S, with which to detach the tumor whatever might be its height. The same end may however be accomplished with the equally long and strong scissors which are employed by MM. Boyer and Dupuytren, and which have only a simple concavity on one of the faces of their blade. They have besides an additional advantage, that of detaching gradually the polypus from any adhesions which it may have contracted with the sides of the vagina before it is drawn down, and its peduncle divided, as happened in a case seen by M. Berard, in which the tumor adhered by one root to the vagina and by the other to the uterus. If the tumor be separated from the parietes of the organ from which it springs by a fissure of more or less depth only, instead of having a foot stalk, and be also a fibrous body, we are not to suppose it indispensable to carry the cutting instrument into the deepest part of this fissure. If we can cut a little above the greatest diameter of the polypus, and give the incision a certain length, so as to divide the whole layer of tissue which surrounds the morbid growth, we require nothing more than the fingers, the handle of the instrument, or mere traction, to detach it, as a nut is separated from the shell which surrounds it.

The membranous and irregular edge which result from the enucleation, either retract and cicatrize or return on themselves, and are partially destroyed by suppuration. Uterine polypi are sometimes so large as entirely to fill the vagina, and even to rise up into the hypogastrium or fossa iliaca. Baudelocque mentions having seen one of which the lower part was in the pelvis, and the other projected above the superior strait. He succeeded in tying the lower part, but when it had sloughed away, Louis objected to searching for the other

half with forceps. The woman died, and Baudelocque asserts that it was possible to have removed it as well as the other portion of the foreign body. It is in cases like this that this author advises the use of those forceps which Herbiniaux had used before him with complete success. All the advantages promised by Baudelocque has since been realized from their use by MM. Deneux, Murat, and Hervez de Chegoin. Now that we have very clear ideas as to the nature of these large polypi we shall attempt their removal with more boldness, as we shall not feel compelled to resort any longer to the ligature. After all, the forceps is not the only instrument, nor is it always the best instrument indicated in these cases. In the month of September, 1830, I was sent for to Bergues by Doctor Mazieres, to a lady who had been brought almost to the grave by an enormous fibrous tumor of the womb, which rose above the pubis, and entirely filled the vagina. Although firm and very elastic, it could be so depressed as that the blade of the forceps continually slipped backwards and forwards. I preferred seizing its summit with the very long forceps of Museux, then to carry up above its thickest part two strong double hooks, one on either side, and to fix them firmly into its substance. Thus seized in four places at once, methodical traction at length brought it into the inferior strait. The perineum, which I was obliged to cut backwards, made long resistance; but at length my index finger giving me notice that the pedicle of the polypus was strongly on the stretch, I slipped up on it a straight bistoury properly protected, and an incision of a few lines allowed the elasticity of the parts to finish the operation. It was a fibrous body, the size of which was equal to that of a child's head. No bleeding followed, and notwithstanding the emaciation and exhaustion to which the patient was reduced, her health, as M. Demazieres wrote me a month afterwards, was perfectly re-established.

There are cases nevertheless in which such is the situation of the tumor that nothing seems capable of bringing it down. A woman, thirty-six years old, was brought into my department of the Hospital St. Antoine, by M. Kapeler, after a long residence in the medical side. In her the tumor filled nearly the whole pelvis, and formed a considerable projection below the strait. It was agreed between Kapeler and Marjolin and myself, that its extirpation should be attempted by the natural passages. I seized it thrice with a common forceps, and thrice I failed to effect its descent. I then, fearing I might unnecessarily increase her sufferings, thought it best to leave her to the natural consequences of her disease. In a few months she died. In the autopsy we found a fibrous body destitute of a pedicle, extensively putred, originating in the thickness of the right wall of the cervix, from which it was otherwise easy to separate it after cutting through the enveloping layer of natural tissue. Another tumor, as large as the two fists only, in contact on one side with the former one, occupied the right side of the uterus, and like it was covered by a thin reflexion of the organ. These two masses, the base of which was as large almost as their greatest diameter, and were larger above than below the strait, could not have been seized firmly enough by forceps to have been drawn down and removed; but the dissection convinced us that their *enucleation* had certainly been possible, notwithstanding the extent of the adhesions, if by any means we could have brought them to the inferior strait, or have carried the bistoury to any point of their circumference. As this kind of polypus does not tear

very easily, it would not be unadvantageous perhaps, when we have succeeded in bringing them out at the vulva, to pass through them by means of a long curved needle, having a handle and pierced near its point, a strong waxed silk riband of which a loop might be made, and thus permit us to pull on them without so much interfering with the other instruments.

If the tumor is of a doubtful nature; if it be possible to draw it down by seizing it with forceps so as to allow the finger to pass over the peduncle; if, as cases are quoted by Levret and Eschenbac, we feel arteries beating in this peduncle; and if, notwithstanding our dissertation on this subject further back, we still dread the prospect of hemorrhage, there is nothing to hinder the previous application of a ligature high up, as Mayor advises, before we practise the excision.

In conclusion, let me observe, that neither ligature, tearing away, or excision is to be attempted where the tumor is still wholly enclosed within the uterus, nor when we are satisfied that it is not the only one, and that others exist in the thickness of the organ beyond the reach of surgical means. All that the patient requires after the excision is injections, at first emollient, then detergent, and finally astringent. If contrary to all expectation hemorrhage does ensue, I think that astringent injections, rolls of lint soaked in oxycrate, eau de Rabel, solution of alum, or else besprinkled with colophany or some styptic powder, would quickly put a stop to it. The tampon, if all were vainly tried, should not as a last resource be omitted.

Art. 9.—*Cancer of the Neck of the Uterus.*

The amputation of the neck of the uterus, is a triumph of modern surgery. Osiander was the first person who positively proposed it towards the end of the last century, and who performed it in 1801. Tulpius, to whom it is attributed by M. Tarral, seems to me undeserving of the honor. The sarcomatous tumors of which he speaks were evidently polypi, which is moreover proved by the figure of that which was removed from his patient Gertruda Turrita. It is nowhere to be found, that he ever thought of exsection of the fundus of the uterus. Lazzari, who claims it for Monteggia, and Baudelocque, who assigns it to Lauvariol, have, I think, both fallen into an error; and I cannot assure myself that it was performed by Andre de la Croix and Lapeyronie, as is contended by M. Tarral. All that can be said is, that Wrisberg recommended it in 1787, and that it was certainly done by many persons through accident before it was ever designedly put into practice. No sooner were the cases of Osiander known in France, than M. Dupuytren hastened to put into practice the ideas of the Gœttingen surgeon, and to test them by many experiments. M. Recamier was not long in following in the same path, so that in 1815 excision of the cervix of the uterus with us was quite a common operation. It was reserved for M. Lisfranc yet further to extend its usefulness, and to demonstrate to the most incredulous the very little danger that attended it. It has now been done so often by so many different people, that it is perfectly needless to enumerate the examples and to reply to the objections made by MM. Wenzel and Zang, who have formally denounced it. The difficult point is to ascertain precisely when it is indicated. The elongation from simple hypertrophia of the neck of the

uterus, does not require it; for it is rather an infirmity than disease. It is equally uncalled for by excoriations, ulcers, and syphilitic vegetations, which are not incurable in their nature. The same thing may likewise be said with respect to induration; to those rugosities, unattended with pain, or with or without chronic swelling, which are so often seen in women from thirty to forty years of age. It is only in well characterized, real, cancerous degeneration, that we may be allowed to perform it. But here is precisely the knotty point in the case; for so long as cancer is unulcerated, and presents only a more or less tumid mass high up in the vagina, its diagnosis is extremely difficult. In the first place it requires great familiarity with the hardness and consistence natural to the neck, the variety of size, projection, density, and of form which it presents, according to the age and different conditions in which the patient may be seen, so as not to apprehend the presence sometimes of a disease of which no vestige really exists. How, indeed, can we be sure that we mistake not as to the nature of an organic lesion, in a part so deep, amid a texture so dense, and amid elements as variable? Nor is this all; were the existence of cancer to be incontestably established, it still becomes necessary to affix limits to its spread. It is rare that all doubts are entirely dissipated on the case until a very advanced period; and then it is almost impossible, to guarantee that the cervix uteri alone is effected, and that the body of the organ is not more or less attacked. The surgeon is then always in fear of, 1st, removing an organ which is not diseased, and of course performing unnecessarily a painful and dangerous operation, or else, 2dly, of removing a portion of a disease only, the remainder of which will infallibly result in the death of the patient. It is a natural consequence of these remarks, that the indication for the performance of amputation of the summit of the uterus must be very rare; and that one need not be astonished if very well informed surgeons are yet in doubt as to its being ever a suitable one. Since we could ask ourselves the question, what advantage arises from extirpation of this disease when it exists in the breast? it would be difficult to have hindered its being asked when the affection was seated in the uterus. So long as extirpation is admitted to be a remedy for external cancer, no one can with reason deny its utility in cancerous diseases of the genital organs, when done under certain conditions. It is even consoling to remark, that in the latter parts, the disease remains longer a local one, and is in reality less likely to reappear in other places, than when it exists in any other part. I cannot myself, then, think this operation ought to be absolutely abolished from practice. It is better to try it than to abandon the patient to certain death, if the spread of it is such as to give any hopes of its total extirpation. Two very different species of cancerous degenerations affect the cervix uteri. Sometimes the disease progresses by ulceration either of the edges of the neck, or of its cavity towards the thickness of its parietes; and the ulcers, which are sometimes covered with fungous vegetations, not unfrequently penetrate into the very interior of the uterus, almost as does the gnawing cancer, the *noli me tangere* of the face and mouth. Sometimes on the other hand, a cerebriforme or scirrhous mass appears in the very thickness of the organ, on or near its free extremity, or at any other point of its extent.

Cauterizing.—Caustics can be applied only to the ulcerated form of cancer; for the tumors can be conquered only by extirpation, properly so called. I

think, that as one is not sure, when the disease has not gone far nor deep, whether it be of a cancerous rather than of any other character, we should first make use of the argenti. nitras. In a more advanced stage of the affection, and when its malignity can no longer be doubted, we may choose between the muriate of antimony, caustic potassa, and nitrate of mercury; or even if we are so disposed, try the effect of the actual cautery. But as our object is not alone to destroy the tissues but to change the action on the morbid surface, and the acid nitrate of mercury is of incontestible value in a host of other affections of a like nature, I think that an advantage would ensue from its general adoption.

The Operation.—After the woman is placed and supported on the edge of a bed, and the parts diseased are brought into view by a speculum uteri, the surgeon wipes and dries the ulcer by carrying up to it on a long pair of forceps, small sponges or little rolls of lint. He then lays a little coarse lint between the circumference of the cervix, and the inner face of the speculum, in order to prevent the caustic from spreading to the healthy parts, and passes up the "cautery stone" (composed of potassa, &c.), or else the nitrate of silver in a conical shape, held in a very long porte-crayon, or one supported on an another instrument to the bottom of the ulcerated excavation. If he prefers the acid nitrate of mercury, he steeps in it a roll of lint or fine linen, and carries it in like manner up to the parts. Before the speculum is withdrawn repeated injections of warm water are to be thrown in, with a view to prevent the action of the caustic from extending to other than the diseased spot. The woman is then put into a bath, and afterwards subjected to the regimen advised after the severer operations.

If the case were one of simple excoriation only, or of slight ulcerations, this washing of the parts by injection would be almost unnecessary, and the other precautionary measures scarcely needful. The operation is to be repeated oftener or more seldom, according to the effects which result from it, every four, six, or eight days; and it is only to be ultimately discontinued when the granulated, scarlet appearance of the part seems to indicate the cicatrization of the ulcers. When it has not been thought prudent to resort to caustics, or when they have been tried with little or no benefit, and that otherwise we are certain the whole of the disease can be removed, there can no longer be any hesitation in deciding upon its exsection.

Anatomical Remarks.—In order fearlessly to amputate the cervix uteri, certain anatomical details should be known. The vagina, which surrounds this part, is thin; in contact at one part with the bladder, at another with the rectum, and continuous by its whole upper extremity with the proper tissues of the uterus itself. In a natural state, this free and depending portion of the organ of gestation is neither three, six, or eight lines in length, whatever may be said about it; but sometimes one and sometimes another of these dimensions, and that without being in any way diseased. The lips of the os tincæ, which in women who have borne no children are closed, but in those who have had families are naturally separated and frequently soft within, knobbed, and as it were fungous even in some cases, and in others more or less tumid, are moreover when in a state of perfect healthiness sometimes greyish, sometimes purplish, sometimes more or less red in color. In married women the anterior labium, which usually is more salient and thicker

than the posterior, is sometimes seen differently characterized. The vagina may be detached from this anterior lip for more than half an inch without risk of opening the peritoneal cul-de-sac which divides it from the bladder, save that as the urinary bladder adheres to its anterior surface very closely, there is a possibility that this part may be reached by the instrument. Posteriorly, the peritoneum does not merely cover the corresponding surface of the uterus. It passes down upon the vagina to form the recto-genital excavation; so that the bistoury on this side would have only to penetrate the thickness of a few lines to puncture it.

It was probably an oversight of M. Mury, who says in his thesis that there is a distance of eight lines forward and ten backward between the summit of labia of the cervix and the serous membrane of the abdomen. The two peritoneal reflexions which fasten the matrix in the pelvis contain only a few vessels, twigs of nerves, and some cellular tissue. In a great many women, being very lax, they permit us to make very strong traction on this organ without any danger, and with scarcely any severe pain. Finally the structure of the cervix uteri, being in a great measure destitute of venous or arterial trunks, the bleeding which follows its exsection is very seldom alarming.

The Amputation.—The method of performing excision of the uterus, did not at once attain that degree of perfection which we see it has reached in our day. Osiander began by passing two silk ribands, with the assistance of a curved needle, through the diseased organ, which he drew and held firmly down by the two loops, so as not to cut it until it came more or less near the vulva. The introduction of two fingers into the rectum, permitted him to cut it above when he could not bring it down; but the invention of his *hysterotome* induced him to relinquish his riband tractors, which he had not used for a long while before his death. M. Dupuytren, and most surgeons after him, have used, instead of the ribands of the surgeon of Gœttingen, a Museux's forceps of great length, with hooks slightly curved, and which easily embraces the diseased part. As this instrument easily tears through the tissues it is sometimes advisable to insert two. M. Colombat has constructed one with four branches. Others contrived instruments which were to be introduced through the os uteri into its cavity, and there opening assume a hooked form, and drag it strongly downward. The most ingenious one on this principle is that of M. Guillon. Another much more complicated was proposed by M. Hatin, and M. Recamier has since invented others. Osiander neglected the use of a speculum. With us, on the contrary, it is almost constantly put in requisition; and many persons have been concerned in bringing it to perfection. That first proposed by M. Recamier was a simple tin cone. To it M. Dupuytren added a handle, which rendered it much more convenient in its application. The ancients possessed one, which is engraved in the works of Pare, Joubert, Manget, and Scultetus, composed of two valves, susceptible of being approximated or parted at pleasure. Following this principle, that of Mdme Boivin is made in two half cylinders, and has at its large end a handle ending in two rings or circles like a pair of forceps. This is introduced closed into the vagina, and by pulling in different directions the two halves of the handle it is made to open a pair of scissors, and to enlarge the canal to be explored as much as is requisite. M. Lisfranc has constructed one different from this, only in having its summit a little flat-

tened, elongated, of greater thickness, and the handle destitute of rings. For the purpose of keeping it open at the suitable width, M. Guillon has added to it a stem, a kind of slide, which detached by the finger allows it to close instantly. The same practitioner, to avoid pinching the tissues, which they are very liable to when the ordinary speculum is used, adds to his, when introduced, a third piece. This plate is made to slide from the base to the point of the two principal halves of the instrument, along a groove which there is on the inner surface of the free edge of each.

Not satisfied with a double branch speculum, the triple speculum, of which drawings also exist in the ancient works of which I have spoken, has been revived. But as it is especially necessary to dilate the upper part of the vagina, MM. Bertze and Colombat have endeavored to produce a speculum, of which the base, when the instrument was closed, was to be at the handle, but at the opposite extremity when open. That of Bertze is composed of two tubes, enclosed one within the other. The inner tube which is divided at its upper part into several elastic branches, is so disposed that these branches separate by their own resiliency when they are set loose, by drawing towards you the tube which serves as their sheath. Eight pieces constitute that of M. Colombat, which together form a hollow cone whose point may be narrowed or opened at pleasure when introduced by means of return screws placed at the two extremities of one of the great diameters of the base. The instrument when open represents a sort of grating, which easily allows of our seeing the neck of the uterus and interior of the vagina at the same time. Of all these varieties of the speculum, the perfected one of Mdme. Boivin appears to me the best. The only reproach which I can make it, is the inconvenience of admitting the entrance of the mucous membrane between the edges, and allowing it to be pinched by them when the instrument is closed. But this objection, which the proposed modifications have as yet very imperfectly remedied, applies with much greater force to the three branch speculum of M. Hatin, to that of M. Colombat, and even that of M. Bertze, which may moreover injure the organs with their points, and do not reflect the light with equal distinctness. With regard to this latter consideration, the primitive, or cylindrical speculum, is still the best, not excepting even the cribriform, or perforated speculum of M. Ricque.

Many kinds of cutting instruments have also been tried. M. Dupuytren has often used with advantage a sort of curette or trowel, slightly concave; which cuts only at its upper extremity, which is convex, and of a semilunar shape. By a circular motion this instrument cuts the cervix uteri at the bottom of the speculum very well, and might in fact penetrate within the uterus, as if to hollow out the organ conically, and remove all the morbid tissues. M. Hatin employs a forceps terminating in two cutting extremities, like the spoon-shaped instrument of Fabricius ab Aquapendente, or the forceps of M. Lobstein, to the stem of his principal instrument.

Again; the apparatus of Colombat is so constructed that his crotched forceps carries with it a stem; at the end of which is a little blade placed crosswise, which by a particular contrivance may be depressed or raised, and which cuts very neatly when made to turn upon its stem all around the cervix above the hooks.

Nothing has been invented, even to the ligature recommended by M.

Lazzari, which has not had its partizans, and which may not, in fact be put in practice. M. Mayor thinks, and not without a show of reason, that by carrying a silk riband up above the disease, by means of the instruments he has for conductors, it would be very easy afterwards to strangulate it with his fillet for effecting constriction.

The truth is that these shades of difference reduce themselves to two methods; one, that which attempts the descent of the neck as much as possible before it is cut; and the other, that which prefers cutting in its natural situation. The latter, at first sight, would seem the preferable one, insomuch as it precludes all kind of pulling and laceration. But it is nevertheless, much the least advisable of the two first, because it does not admit of an equally exact appreciation of the state of parts, and of getting equally near to the uterus itself; and then, because it is in fact, much less easy of execution. It deserves a preference, only in those cases in which the uterus is so firmly immovable, as that the ablest combination of tractive efforts cannot bring it into the inferior strait, which must be a very rare event, for to cut off the os tincæ with any chance of success, the disease must be complicated with no other affection and with no alteration in the uterus or its appendages. The fillets of Osiander since the improvements made in the crotchet forceps can no longer be retained in use in the first method. To me the speculum, whichever it may be, seems much more embarrassing than useful. Directing their introduction with the fingers of the left hand, it can never be very difficult to place the forceps around the neck, and no one can doubt the greater facility of manipulation in a free vagina. If it becomes necessary to multiply them to prevent any tearing whatever of the parts, it is certainly better to imitate MM. Dupuytren and Lisfranc, and place a second pair of forceps above, or in an opposite direction to the former. I have always found the straight bistoury, wrapped round with its little bandage to a short distance from its point, more convenient than any other, as it may be carried so far up into the vagina. I have only to add that instruments of traction which unfold in the interior of the organs, are dangerous for the most part, and should be formally proscribed. It is difficult to do without a speculum, when the cervix has to be excised in its natural situation; and the "speculum brise," owing to the want of space and freedom of motion, is in this case the only one which can answer the expectation of the surgeon. Then also the scissors slightly curved, the cutting ring, the curette of M. Dupuytren, or the bistoury concave on its flat side near the point, would come into use.

The Method of Operating.—The speculum being selected, one or more forceps of Museux, the bistoury which one prefers, the scissors or curette, some lint, compresses, and a T bandage are all the things that are wanted. The position of the patient is the same as in applying the caustic. One assistant holds her head and arms, two others take charge of the lower limbs, a fourth hands the instruments as they are successively needed. The surgeon seated in front of the vulva, begins, if he has resolved upon using it, by introducing the speculum; after he has besmeared it with cerate he slides it gently in the axis of the pelvis, pressing principally on the posterior commissure of the pudendum, and so passes it up to the seat of disease; then as the cervix presents more or less perfectly at its extremity it is to be turned forwards, backwards, or sideways; whereas, if it be the speculum "brise" it is to be

opened so as to spread asunder the whole vagina, and expose the whole extent of disease. If we suppose that he wishes to leave it in that particular situation to apply his forceps, he gives it in charge to an assistant, until he has properly disposed of them. He then withdraws it, and the speculun "brise" here offers a very great advantage in allowing of the easy disengagement of the forceps above. If he neglects to employ a speculum, two fingers of the left hand are first to be carried up into the vagina; where after having examined the form and extent of the disease, they are to remain. The closed forceps is then passed up on their palmar surface, which is opened when it reaches the cervix, and applied as high up as possible, so high at least as that the hooks may be fastened into a healthy part of the uterus. With this forceps, which is to be implanted rather by pushing than pulling, he makes gentle traction, and endeavors to bring the part down into the vulva. It is better in making these tractive efforts, to employ only the right hand rather than both, acting always in the direction of the pelvis, and to use the fingers of the left hand to protect the hooks of the instrument, which should never be abandoned. If he perceives the forceps to slacken their hold, or that the points are about to tear what they embraced, he immediately gives the first pair to an assistant to hold, and inserts a second into the opposite diameter of the cervix.

When the parts appear outwardly, he has the two sides of the vulva parted carefully, gives the instrument or instruments of traction to some one, calls for his bistoury, carries it in the first place to the right side, and always above the disease, brings it forward; then over to the left side: or he might perform the section of parts from behind forward, and from left to right. If the affection seems not entirely circumscribed he should proceed to detach the adhesions of the vagina one by one, so as to remove not only the os tincæ, the upper part of the neck, but also to hollow out conically the inferior part of the uterus itself if it appears to him to be necessary. As soon as the section is finished the fundus uteri rises and resumes its natural situation. If some portions of diseased tissue or cancerous tubercles have escaped the knife, we must reintroduce the speculum, seize them with forceps, and without hesitation cut them away or destroy them by caustic. When, as happens in an immense majority of cases, there follows no bleeding, no dressings are required. Injections of tepid water, or of cold water as is advised by some, for a few days is all that is done. I can see however no objection to slipping up to the bleeding surface a shift-shaped piece of fine linen, to be softly stuffed with balls of lint, if blood should flow too abundantly, and the state of the patient such as to make us lose nothing. This shift would render plugging very easy, and would expose to no danger which was not easily remediable at the moment.

Thus far I have performed twice only excision of the cervix uteri; in neither case did I require any thing besides Museux's forceps and a straight bistoury. In the first female I removed the whole neck. The operation was quickly over, easy, and gave but little pain. Some blood flowed, which simple means soon arrested; yet she died nevertheless on the third day afterwards. On opening the body, neither peritonitis nor any other appreciable lesion was discernible. The remainder of the uterus was healthy, but a small cerebriform mass existed on the right side behind the vagina. An aperture of two

lines in width occupied this side of the vulvo-uterine canal, and communicated with the genito-rectal excavation. We could not determine whether it was effected during the operation, or in the autopsic dissection. It was quite certain, however, that no fluid had been effused from it.

In my second case, having experienced some difficulty in bringing down the cancer to the orifice below, I carried up the straight covered bistoury without any great trouble, to a depth of two inches into the vagina and above the limits of the disease, and directing its progress on the palmar surface of the fingers of my left hand, thus completed the operation. This patient who at first appeared to be doing well, died at the end of six weeks. She had several cerebriform tumors existing on the right lumbar region and deep in the right broad ligament of the uterus. A patient on whom M. Blandin operated died of uterine phlebitis. One of those whom M. Lisfranc lost, perished from peritonitis; others are carried off by a state of nervous depression, of the severity of which it is impossible to assign any explanation. Thus far, no one has fallen a victim solely to the loss of blood. MM. Rust and Græfe of Berlin, MM. Roux and Dupuytren, who have seen several die owing to the immediate sequelæ of this operation, have never attributed the fatal issue to this occurrence. Exsection of the cervix of the uterus, then, though easy and often unimportant, is nevertheless sometimes extremely dangerous and speedily fatal. Nay, from the view taken of it in the beginning of this article, it should seem that success could follow it but seldom. But Osiander for all this performed it eight and twenty times; M. Dupuytren fifteen or twenty times; and Lisfranc forty or fifty times, with not more than one case fatal in six or seven. Women on whom it had been performed have repeatedly become pregnant, and have been delivered without accident. M. Dupuytren even relates a case in which he repeated the operation for a return of the disease, which recovered also the second time. Lastly, it is said, that cures thus effected are in most cases radical ones.

I shall not enter on a consideration of the question, whether since it has been practised, excision of the cervix uteri has not been performed very often when no cancer existed in it, as some persons have asserted; but shall confine my remarks to stating that M. Dupuytren, who, as it were naturalized the operation in France, now seldom resorts to it; that M. Lisfranc, in whose hands it has been so successful, does it much more seldom than formerly; and that, according to M. Heisse, Osiander himself had ceased to perform it at all for sometime before his death.

The two instances recorded by M. Stoltz of Strasbourg are certainly not more calculated to exalt our idea of its utility.

Art. 10.—*Extirpation of the Uterus.*

Historical.—Removal of the uterus has so long been looked upon as an impossibility, that it has been doubted, even in our times, whether it had ever really been done. A different opinion has prevailed among some authors, however, in almost every age. Soranus, to prove the unimportance of this organ to the woman, states that it may be removed without fatal consequences; "as," he adds, "is testified to in the works of Themison;" and he even goes so far as to enforce the operation as a precept; for he advises that

when it putrifies it is immediately to be extirpated, without any reserve, and positively asserted that its entire removal has sometimes been done with success. In Bauhin's additions to the work of Rousset may be found nineteen cases which evince the boldness of the physician of Ephesus; while Schenck of Graffemberg relates a still greater number."

All these accounts, however, as there are amongst them so many which are wanting in authentic proof or sufficiency of detail, have been rejected as inconclusive; and with greater propriety as many were performed by midwives, many by quacks, and again many by very ignorant surgeons; and that besides, it is so easy to be deceived by inversions of the vagina, polypous or sarcomatous tumors, that unless the facts had been established by autopsic examination, the mind must continue to entertain doubts as to their truth. Rousset in his book gives moreover so many evidences of a want of fidelity, and Bauhin and Schenck seem to have been so credulous, that one is naturally led to doubt their testimony. Who can believe that extirpation of the uterus was performed on the woman spoken of by Plempius, who notwithstanding afterwards became pregnant? In the other, who according to Plater retained her sense of venereal enjoyment, and continued to menstruate? In the third quoted by Schenck, from Carpus, in that mentioned by Morgagni, from Weideman, all of whom presented the same phenomena? Is the testimony of Vieussens a much more credible authority, at all events more conclusive, who in giving an account of an examination of a female in whom the matrix had been removed fifteen years before, admits that a portion of the organ was left at the fundus of the pelvis? And the case of Pierrette Boucher, who had been operated on three years previous, and whom Rousset caused to be disenterred three days after her death, and opened before a physician and a midwife not named, may not this be an account of pure invention got up for the occasion? Yet it cannot be disputed now-a-days, that removal of the uterus has several times been performed, and that in some cases the patients have survived it.

Not to speak of those cases cited by Moschion, Avensoar, Rhazes, Mercurialis, Wœga, Fernel, and others, we meet with one in the works of Pare which cannot be considered as doubtful. The operation took place on the King's day, 1575, and the patient lived three months afterwards, and died of some other affection. On the examination of the body, Pare demonstrated the absence of uterus, and he remarks as a circumstance deserving of notice, that nature had confined herself to *building* (batir) a mere hardness at the fundus of the pelvis, in room of the extirpated organ. Under this view of the subject, the principal facts known as to the early history of this proceeding, may be arranged under two principal categories. In the first, prolapsus of greater or less standing of the organ existed; the second relates to it in a state of inversion. Among the former, we place the account given by H. Saxonia, of a Venitian servant woman, who tore away the prolapsed uterus with her own hands; the cases by Paul of Leipzig; by Cohausen, Tencel, Goulard, and also those which have since been made known by Laumonier, in 1784; Clark, Vanheer, A Hunter, in 1797; by M. A. Petit, Hosack, Galot de Provius, in 1809.

Should all these relations not be adopted as facts, and it appears evident that Laumonier, and Bardol amongst others, removed merely a polypus, and not

the entire uterus, the same thing cannot possibly be said as to M. Galot, who conveyed the specimen to the Society of the Faculty of Medicine at Paris; nor as to M. Marschall of Strasbourg, to whom an opportunity was afforded ten years afterwards, on the death of the woman, to prove by the dead body the removal of the gestative organ.

In 1822 this operation was successfully performed by M. Langenbeck. The cases published by M. Fodere in 1825; those of MM. Recamier and Marjolin, contained in the Revue Medicale of 1826, as well as that just announced by M. Delpech, admit no longer of any hesitation on the subject; and it is clearly proved that the prolapsed uterus has frequently been removed from the living subject unattended by a fatal issue.

Under the second series of the categories, which like the first contains its doubtful facts, and others more or less certainly true, may be included the case related by Ulm, who states that a midwife in pulling at the cord, having inverted the uterus excised it at one stroke of a razor; the other by Bernard, nearly alike, except that the woman recovered; a third of the same kind related by Wrisberg; that by Viardel; a fifth which occurred in Lower Poiton and published by Caille; that recorded by Anselin, of Amicus, in which he himself removed the inverted organ. To it likewise belong the cases of R. Baxter, Mullaer, Jean Muller, and of Sorbait; those related by Figuet of Lyons, by Faivre of Vesoul; as well as that in which it is said that Desault excised a portion of an inverted uterus in the removal of a polypus. Without including in the account the cases of Gattinaria, of Berenger de Carpi, and Fonteyn, mentioned by M. Dezeimeris, there must still be added to this list those by Messrs. Charles Johnson, in 1822, Newnham and Windsor, (1809,) Rheineck, Davis, Chevalier, Weber, Dr. Gooch, Cordeiro, &c. It is owing to the distinction not having always been made between removal of a uterus previously prolapsed out of the pelvis and that of one in which no displacement from its natural seat had occurred, that all the doubts and vagueness about this latter operation have existed, even to the period in which we live. Without such a distinction, it is in fact impossible to understand the subject; for the two circumstances are far from identical.

1*st. Of the Displaced Uterus.*—When every attempt at reduction has been made in vain, and the disease threatens to destroy life, the operation before us becomes indicated; but it is at the same time to be remembered that prolapse merely of the uterus is rarely fatal; that it may be a mere infirmity; that it often allows of pregnancy within it, as is proved by the case reported by Marigues of Versailles, and that of M. Chevruel; that usually the general health is but little impaired; and that in order for a surgeon to decide on this step, some degeneration or morbid condition in itself dangerous must be superadded to the descent of the organ. It is usually so easy to reduce its inversion after delivery of the fœtus, that it is only an exception to the rule that it can require the performance of so dangerous an operation.

If however the woman should have been ill treated; if brutal and ignorant manipulation have induced gangrene, or disorganization of the uterus, to a degree which precludes all hope of its reduction or preservation, exsection presents a resource of which we should do wrong not to avail ourselves. It ought to be a rule never to separate from the body a uterus which has descended out of the pelvis, without some very clear and urgent necessity.

Admitting, as proved, the occasional successful result of its removal, it is but just to confess the dangers which attend it; and not to forget that the woman spoken of by Blasius, Farbricius, Hildanus, and Ulmus, operated by their midwives, all died; that the patient of MM. Recamier and Marjolin survived only two months; that an unhappy woman received at La Charite, in July 1824, whose uterus had been tied eight days before by mistake, died also in a few weeks after; and lastly, that if the facts related by MM. De la Barre and Baudelocque, in which a spontaneous disappearance of an inversio uteri occurred at the end of several weeks in one woman, and after lasting seven years in the other person, be correct, amputation of it in such cases can be seldom indispensable.

Method of Operation.—Those who have performed this operation of ablation of the uterus through ignorance or rashness, have done it in a manner that deserves no discussion. No one now would think of tearing it away, or excising it with a razor or kitchen knife, without any previous precaution; or of hot coals or other caustics which have been employed by some women on themselves, by quacks, matrons, and the older authors. The rational methods, from which we may be permitted to select, are strangulation, with or without immediate amputation; pure or simple excision; and extirpation, with a dissection of the peritoneum.

Ligature is extremely easy, for beneath our eyes we have the pedicle around which it is to be placed. But then the pedicle is rather large, and the pain caused by its constriction has at times been so excessive as to threaten the life of the patient; so much so, that in M. Marschall's case, among others, it was necessary to cut the thread very soon; and resolve upon excision at once, which was entirely successful.

By using a ligature, moreover, we run the risk of including the urethra, as was seen by Ruysch, or a kunckle of intestine, as did a quack mentioned by Klein, or the bladder, &c. Mr. Windsor, with a view of performing a more speedy section and of giving less acute pain, pierced the root of the tumor, as Faivre had done before him, with a double riband, so as separately to encircle both halves. The observation of Clark, Neunham, and Recamier, proves that an ordinary ligature is not always dangerous.

By excision the patient is more quickly relieved. As the ligature can be of no use but to prevent hemorrhage, one does not see the advantage there would be in trusting to it alone the destruction of the uterus. If strangulation then be adopted, either simple or by dividing the root of the body to be cut away into several portions, to me it seems advisable to cut away immediately afterwards the parts which are beneath it. This was done by Baxter, Bernard, and a host of others. To avoid wounding an intestine, or the apparatus for the excretion of urine, it is sufficient to impress a few gentle shakes on the pelvis, by having it raised on the bed above the other parts of the body. Besides this, the pain which ensues from pinching an intestine, the only accident which can happen of this kind, and which cannot be always avoided, will quickly indicate its occurrence, and can be easily remedied without delay; while the bladder and urethra would always be out of the way of danger, unless the riband were carried very high up indeed, which was done by a quack whom Ruysch mentions. The multiple ligature, which has undoubtedly the same advantage here as in epiploic hernia, gives less pain,

because it causes less traction and folding in on the root of the organ, cuts the parts more quickly, and is less disposed to slip or slacken, when excision is conjoined to its application, than a common ligature is.

It appears to me that excision of a prolapsed uterus of long standing ought not less generally to be preferred to ligature. The only risk attending it is of hemorrhage. Now the vessels which the peduncle of the tumor contains are not large enough to make this dread a very serious one. Moreover what is to prevent us from using the ligature to it, if it should appear necessary, or else employ topical astringents, tampons, or the potential cautery. Excision, as it is more prompt and less painful, offers a great advantage over strangulation, and ought to ensure a greater ratio of successful results. It was that which was practised on the patients of whom Pare, Bernhard, &c., relate the cases. I do not see the benefit of imitating M. Langenbeck's proceeding. The female on whom he operated, had an incomplete prolapsus with scirrhous degeneration, like those of MM. Ruysch, Hosack, Wolf, Fodere, and Recamier. This surgeon thought it necessary to dissect off cautiously from the exterior to the interior the whole of the uterine reflexion of the peritoneum, so that after removal of the organ this membrane was found to be uninjured. It is true that his patient got perfectly well, and is living to this day. The passage of air into the abdomen through the vagina, which is thought possible even after recovery by Rousset, who has cited a case, and by Siebold, who attributes to it the death of one of his patients, is thus surely prevented. Let it be observed, that all this latter apprehension is mere assertion, easy to refute: and that if M. Langenbeck's plan is to be followed it will become one of the longest and most difficult operations in surgery.

2d. The Uterus not Displaced.—A question which naturally follows the preceding observations, is that which relates to removal of the entire uterus from its natural situation. If Lazzari is to be credited, this operation has been thrice performed near the beginning of this century by Monteggia. Siebold asserts that it was once done by the elder Osiander, and with success. It is at least certain, apparently, that it was really practised, April 13th, 1812, by M. Paletta—but on his part undesignedly. He meant to remove nothing but the cervix which had become cancerous, and only discovered that the entire uterus had been exsected, upon examining it after the operation. To Doctor Sauter, of Constance, then the merit is due of having first conceived the project of this operation; and of having executed it after a rational method and upon fixed principles. It may now be asked, whether if exsection of the uterus be really practicable, it is useful; and in what manner it may become dangerous. A few words on each of the cases we are acquainted with will enable the reader to decide these points for himself.

M. Sauter's patient died four months after the operation, which was on the 22d January, 1822; and, says the author, of a paralysis of the lung; the bladder had been injured. On the 5th of February, 1824, M. Hoelscher followed the surgeon at Constance. In twenty-four hours the patient died; and the body showed symptoms of peritonitis. The woman on whom Siebold operated, April 19th, 1824, lived sixty-five hours only, and she died of peritonitis. In the patient on whom M. Langenbeck operated January 11th, 1825, and who died in thirty-six hours, traces of peritonitis were also visible. Sie-

bold performed the same operation on a second woman, on the 25th July, 1825. She was dead on the following day, and with the same phlogosis as the others, besides evincing, when opened, many organic lesions which ought to have been known beforehand. On the 5th August of the same year, M. Langenbeck had recourse for the second time to extirpation of the matrix, and the woman who died in fifty hours after, offered, as did the others, incontestible evidence of peritoneal inflammation. Of four patients on whom Dr. Blundell operated, three died—one after thirty-nine hours, another in nine hours, and the third very quickly; but the precise lesions which were found on examination of the bodies are not known. The first of the four who had been supposed cured, died at Guy's Hospital a year afterwards of a return of the cancer. Mr. Banner's patient, on whom he operated on the 2d September, 1828, died on the fourth day of peritonitis. Mr. Lizars of Edinburgh, wishing to follow in the steps of his two fellow-countrymen, performed the same operation on the 2d of October, and the patient died within the twenty-four hours. M. Langenbeck, a third time repeated it in 1829; the patient survived only a fortnight. On the 26th July, 1829, M. Recamier, first performed it in France. He appeared to have better success than any preceding surgeon, yet like Dr. Blundell he had the misfortune to lose his patient at the end of a year's time; unfortunately no autopsia could be made. I have only learned that she sunk under chronic diarrhœa and a long continuance of febrile irritation.

In September, 1829, M. Roux performed the operation in his presence; the patient in his case dying on the evening of the next day. The professor a few days afterwards again practised excision of the uterus, but under very unfavorable circumstances. The operation was long and painful; abundant hemorrhage ensued, and death resulted at the expiration of twenty-five hours.

M. Recamier did it again on the 13th January, 1830. Here also considerable bleeding occurred, and the woman lived only thirty-three hours. M. Dubled, operated on a case on the 20th June, 1830, which survived only twenty-two hours, and died of symptoms of debility, of which the examination of the corpse furnished no explanation. M. Delpech, who in his turn thought fit to attempt its performance, was not more successful than others; his patient died on the 3d day, but not he assures us of peritonitis. The English Journals, give a last case, that of Mr. Evans, and which seems to have been successful; but I have not accurate details enough about it to speak of it more fully.

We see by this enumeration, rejecting the doubtful cases of Monteggia and Osiander, and including that of M. Paletta, whose patient perished on the 3d day of highly acute peritonitis, twenty-one performances of the ablation of the uterus, perfectly authentic and incontestible, all done within twenty years, and not one permanent cure effected out of the whole number! Is there a more appalling statement to be met with in the records of surgery? And is not this melancholy result sufficient to banish this operation from practice for ever?

For all this, the disease which it is performed to remove is so common, so invariably fatal, and leads to the grave through so much pain and anguish, that this last hope will not be abandoned without regret which seems occasionally to have been opposed to it with some success; some persons will

again probably venture upon its repetition, and the preceding facts will not appear to all such as to warrant its final and complete proscription. Amid the dangers to which it exposes the patient, that of peritoneal inflammation is of chief importance. But yet in every case this result has not followed. The patients of MM. Sauter and Recamier and of Dr. Blundell, who survived its performance, were not affected by it, nor did the bodies of all who died evince its uniform presence. To this it can be replied, that with regard to those who died the most speedily, say in less than twenty-four hours, peritonitis could not have yet developed itself, although even it were a necessary consequence of the operation. On the other hand, if it be considered, that traumatic peritonitis may often be averted, and that medical art is not without the means of subduing it when it is developed, it does not follow that on this account ablation of the uterus must be driven from practice.

Hemorrhage is another occurrence of great moment, and often serious; many have been attacked with it, as may be seen in the cases operated on by M. Roux and Recamier, and as has happened also in Germany and in England. Still in the majority it did not occur, and we may be permitted to express the hope that the perfection which operative medicine is attaining will some day or other enable us to avoid it with considerable certainty. Some it is said have sunk beneath the exhaustion of suffering and distress. Be it so; to this at least, in part, a remedy will, we may hope, hereafter be provided from the nature and position of parts to be removed. It is yet a question to be solved, why women who have survived the first and violent tempest and the immediate consequences of the operation, have continued to languish, and have died at last? For this event, neither peritonitis, hemorrhage, nor suffering can be held responsible. To those who think that the death of these females was owing to the privation of uterus simply, the case mentioned by Vieussens, which survived fifteen years, that of M. Marschall, whose patient died at the expiration of ten years, and that of M. Langenbeck who is yet living, from all of whom the prolapsed uterus had been removed, will be a sufficient answer.

Whatever it may be, we see what chance is offered of recovery from extirpating a cancerous uterus when performed under those circumstances in which only it is admissible to attempt it. If we seek to reduce these conditions to great preciseness we shall find it no easy matter, and shall discover how very rare their combination in one person must be. So long as cancer has not attacked the whole organ, pure and simple excision, which admits of our ascending very high up, ought to suffice, and should alone be essayed. It was by means of excision, that Bellini extirpated the lower half of the uterus, in 1828, with complete success. It was excision also which M. Dubled proposed as a substitute for ablation or extirpation in his work which was presented to the Academy. But when, on the contrary, the disease possesses the whole uterus, how can we be certain that it has attacked no other organ also. It is very true that by introducing the finger alternately into the vagina and into the rectum, whilst the other hand is applied to the hypogastric region, we may often acquire motives for suspecting the existence, or of believing on the non-existence of material alteration in the pelvis, in the region of the ovaries and their tubes; in a word, of the uterus and its appendages; but the most experienced practitioner even then can learn but greater or less probabilities, and never

attain to any certainty of opinion. Shall we then with all this uncertainty decide upon the performance of this fearful operation? To render those proceedings with which we are acquainted proposable, even when the uterus alone is supposed to be affected, the organ must at least preserve its natural mobility, and be free from unnatural adhesions. Now whilst it is found under these circumstances, it is not in all probability throughout diseased; and if so the idea of its excision ought to present itself to the mind. How, lastly, are we to decide in an early stage of disorganization, by merely feeling with our fingers through the parietes of the abdomen, rectum, and vagina, that the body of the uterus is really cancerous, or that it is a little smaller, or a little larger than usual in a normal state? Two principal methods, the one called hypogastric, the other sub-pubic, have been projected for extirpating the uterus. If Musitanus is to be credited, extirpation of the matrix through the hypogastrium is far from being as novel as is generally believed. In fact, this author says, according to Wier, that a girl of exceedingly salacious disposition was thus operated on by her father, who made an incision into the lower part of the abdomen, and through this sought for the uterus and removed it on the spot. It is however probable, that the peasant of whom Musitanus speaks did no more than remove the ovaria, which is done to the females of domestic animals, but without touching the womb itself. The same remark applies to passages in Ætius, Schurigius, and others; wherein it is stated that surgeons have ventured to open the abdomen of certain women and to take out the gestative organ. Be this as it may, the hypogastric method was described and proposed, in 1814, by M. Gutberlat, who upon the subject enters into the most circumstantial details. He makes use of a sort of ring fixed upon a long handle, which is carried into the vagina, and by embracing the os tincæ, serves to fix the organ in the abdomen. He then makes an incision of sufficient length, in the extent of the linea alba, above the bladder, which allows of the introduction of his left hand into the abdomen, and then with scissors carried in by the right hand he is enabled to detach the broad ligaments and upper extremity of the vagina, and extract the uterus entire. It does not appear that the author ever practised his method upon the living subject. Judging from what occurs in the dead body, the ring, &c. of which he speaks can answer only when there is no enlargement of the neck; and it would be moreover a very hazardous means of protection to the bladder, and not to be relied on. The separation of the uterus is really very easy in this way. I believe that M. Langenbeck was the first person who ventured to perform it during life. But with as light variation from Dr. Gutberlat's method, he advises, that before meddling with the uterus we assure ourselves by the finger and eye of the condition of the tubes and ovaries, that they may equally be removed if they participate in the disease. And he likewise thought it better to open the peritoneum from the vagina, as a greater security against injuring the bladder. Many of the modifications of this able surgeon, are however unfortunately more apt to complicate than perfect the hypogastric method as recommended by Gutberlat. This method has also been put to the test of experiment in France by M. Delpech, who prefers previously to detach the uterus forwards by the vagina, and that to get at it across the hypogastrium a semilunar incision be made in the side of the median line, the convexity of which is to look outwards, so as to have a large flap, which

being turned back on its right edge, gives room to the surgeon to manipulate freely at the fundus of the pelvis. If it should be ever proved, that large openings may be made into the parietes of the abdomen without danger, the hypogastric method, more or less perfected, would ultimately make extirpation of the matrix easy enough to do. But it is not the way to make it of general prevalence to combine the sub-pubic operation with it, any more than the incision into the perineum, as proposed by Frere Come, to bring about the adoption of the sub-pubic operation for stone. One operation is quite sufficient without combining the two. Of the twenty-one cases known in which removal of the uterus was practised, nineteen were performed by penetrating from below upwards. M. Sauter, who could not bring down the organ as was done by Osiander, divided the vagina ascendingly by small incisions on the anterior surface of the cervix uteri, succeeded in anteverting the organ, separated the broad ligaments successively, and finished by gradually isolating it from the rectum. Hoelscher and Siebold operated in almost the same manner. Once however the latter was obliged to cut the vagina laterally, to facilitate the introductions and motions of his fingers within. He also thought it advisable to take the precaution of introducing a catheter into the bladder, so as to protect it or direct the motions of the bistoury while he separated the vagina from the forepart of the uterus. M. Langenbeck began by making an incision of the perineum from before backwards; then divided the vagina backwards, forwards, and upon its sides; lastly seized the uterus by its fundus, and completed its detachment by cautious dissection. Dr. Blundell, by detaching the vagina backwards, enters at once into the recto uterine fossa of the peritoneum, he then seizes the fundus of the uterus with a hook, retroverts it, divides the broad ligaments, and finishes by its separation from the bladder. Mr. Banner preferred turning the organ over on its side, after having detached it behind, in front, and off of one of its broad ligaments, rather than effect its overturn on one of its surfaces. His operation ended in the section of the remaining ligament. The incision into the perineum made by Langenbeck, was by Mr. Lizars carried quite into the rectum; he then divided the vagina on both surfaces of the diseased organs before reversing it.

In France, MM. Recamier and Roux have always followed the procedure of M. Sauter, modified in two particulars. M. Recamier recommends the use of tractors, such as were previously mentioned, if they can be introduced: or if this is not possible, the carrying up into the uterus of one brarch of a double hook forceps, the other branch of which should have three points, and be applied as high as possible on the exterior face of the neck. If this cannot be done, he then advises the use of the instruments of Museux, either simple or jointed like the forceps, bent of Z shape, or only at a right angle, as proposed by M. Tanchou, at the outer third of their handle, so that they may not too much conceal parts during the remainder of the operation. With one or other of these instruments the cancer is to be drawn down as far as possible, A straight bistoury, guarded by the right hand, serves to detach the vagina from below upwards from the forepart of the uterus, then to effect the separation of the matrix itself until we arrive nearly to the peritoneum, which is afterwards to be opened with a pharyngotome, a convex and probe-pointed bistoury, or some cutting instrument. The same bistoury, the probe pointed one, or better still a curved bistoury, still guarded by the finger and passed

in at the peritoneal opening, and carried alternately from left to right, is sufficient to detach entirely the anterior surface of the organ from the bas-fond of the bladder, and to lay bare the origin of the broad ligaments. The index finger, passed up above the fallopian tube easily glides upon the posterior surface of the peritoneal reflexion, and permits its being cut from above downwards, in all the thickness of the fold to its inferior third; and allows the rest to be included in a strong ligature. Having done the same thing on the opposite side, M. Recamier finishes the section of the broad ligaments, turns over the uterus forwards, and detaches it from above downwards from the rectum.

The ligatures employed by M. Recamier, are applied upon the inferior halves of the peritoneal pinions only, because, according to this surgeon, the principal vascular branches are here situated. He is even of opinion, more over, that it would be possible, with a finger in the rectum and another in the vagina, to discover the uterine artery by its pulsations, and contrived to tie it in the lower part of the ligament in which it lies. This would constitute a separate operation, and should be done three or four days before the principal one is performed. This modification is equally thought very easy of execution by M. Gendrin; he considers it as very essential, and accordingly strongly advocates its adoption. This gentleman also advises successive isolation of the uterus in all its circumference, and that at the close of the operation, it be turned on its own axis, and not reversed or turned over. Instead of placing his ligature below the insertion of the tubes as is done by M. Recamier, M. Taral on the contrary begins by surrounding with it the whole of the broad ligament, using for this purpose a curved needle, like that of Deschamps, and the left index finger and thumb, to carry it round. M. Taral, likewise, advocates the introduction of a catheter or sound into the bladder, so as to use it, at the instance of Siebold, as a guide to the vesica during the dissection of the vagina off the anterior surface of the uterus. Injury to the bladder may be much oftener avoided, he says, by raising up its fundus before the cutting instrument with the index and middle fingers, whilst separating the tissues in that direction, even until the peritoneum itself be opened into, than by tearing the cellular layer rather than cutting it.

M. Dubled, lastly, is of opinion, that after having got the uterus down as low as possible, and destroyed its adhesions from one broad ligament to the other, first before and then backwards, a ligature should be passed below the roots of the tubes across the lateral ligaments, so as to embrace their two lower thirds, and to allow of their being cut between the string and gestative organ, and that then it would be easy to amputate the uterus as far as its fundus or upper edge, so as to leave the tubes, ovaries, and round ligament, *in situ*, and also without necessarily opening the peritoneal cavity. But it is evident that this method has nothing to do with complete extirpation of the uterus: and that it is no other than a perfected state of its excision as performed by M. Bellini.

It would be difficult to say which of these methods, so various, is the best adapted for the purpose; and more particularly as none have been followed as yet with complete success; and that those which appeared to be followed by cures were done by different methods. M. Sauter's patient in whom the uterus was turned over forwards, lived four months; that of Dr. Blundell, who lived for a year, was operated on by the posterior reversion. The patient of

M. Recamier, who remained cured, was operated on after this gentleman's peculiar method.

The perfecting of this operation, as proposed by MM. Gendrin and Taral, having as yet been practised on dead bodies only, I shall not here discuss its advantages, or the objections against it. Moreover, as it will, if ever again performed, be long reflected upon before it is undertaken, and as it is probable that each one will feel at liberty to adopt some modification of these modifications, I should fear to trespass upon the time of my reader, did I dwell longer upon those I have thus briefly described.

Art. 11.—*Vesico-vaginal Fistula.*

Vesico-vaginal fistula, notwithstanding the frequency of its occurrence, the difficulty to which it gives rise, and the disgust which it creates, has hitherto been subjected to few surgical procedures for its removal. Either as the result of difficult labors, of ill conducted obstetrical manœuvres, of gangrenous perforation, of contusion or other traumatic lesions, it is an affection from which a spontaneous recovery is impossible; nor does the want of success which has hitherto attended the attempts that have been made to relieve it, justify the almost complete silence with which it is passed over by standard authors. There are several sorts of treatment which may be applied to it.

1st. *Suture.*—Suture, which naturally first presents itself to the imagination, is of such difficult performance, that few surgeons have attempted it, and in the works which have issued from the Parisian school it is scarcely alluded to. To attempt to stimulate the edges of a wound which one knows not how to lay hold of; to bring it together by thread and needles, when there seemed to be nothing to fasten; to act upon a movable septum, out of sight between two reservoirs, on which scarce any hold can be taken; has always appeared capable only of inflicting unnecessary pain on the sufferer, and has accordingly generally been refrained from. Roonhuysen, who is said by M. Chelius, to have first advised it, did not put it in practice. If I have understood rightly, it was his nephew who spoke to him about it, and who thinks that after having quickened the life of the edges of the ulcer, it might be possible to transfix and approximate them by a quill sharpened to a point. The success said to have been obtained by the use of sutures by Walter, Fatio, Schrœger, and others, is not invested with proof so positive as to produce an entire conviction of its truth. But we can no longer entertain any doubts of its efficacy. The repeated observations made by M. Nœgele, in 1812, give reason to anticipate success in many cases. Following the footsteps of the professor of Heidelburg, M. Ehrmann proved its value on a patient confided to him by M. Flamant; and the essay published by M. Deyber informs us that he was himself, in conjunction with the latter gentleman, equally fortunate in the case of a woman whom they treated at Strasburg. The fistula, which in the first of these cases was very broad, in the other very narrow, was a long while in cicatrizing after the stitches came away, and attended with much suppuration; so that the case did not result from immediate contact in the parts. In 1828, it was done with a like happy result by M. Malagodi, of Bologna: while the unfortunate attempts made by M. Roux at

La Charite, in 1829, make neither for nor against it, since the symptoms which preceded the death of his patient, were not at all such as are naturally attributable to the introduction of the suture.

Method of Procedure.—The following is the manner in which M. Malagodi operated. He placed his patient and caused her to be held as in the operation for stone; carried the index finger with a leather stall into the vagina, and through the fistula into the bladder; used it as a hook to draw out one of the lips of the bladder a little towards the vulva, and cut its callous portions with a straight bistoury; did the same to the other side of the fistula by changing hands, and then began to insert the stitch. For this second stage of the operation M. Malagodi again laid hold of one edge of the wound as before with the left index-finger;—conveyed a small crooked needle to near its posterior extremity at a distance of two lines without; brought it again by a circular sweep from the bladder into the vagina so as to make it cross the *vesico-vaginal septum*, and afterwards disengaged it. Another needle fixed to the other end of the string was also carried through the fistula, and brought out from the bladder to the vagina to be withdrawn as the first had been. The surgeon applied a second and third stitch in the same manner, tied each separately so as to obtain an exact coaptation, and concluded by cutting them very accurately close to the knot with scissors. A catheter was kept in the bladder, and the patient confined to her bed. The first and second day the urine passed entirely by the catheter; on the third a few drops were seen to have escaped by the vagina. The two posterior stitches had perfectly succeeded. That nearest to the urethra had torn through the tissues. It was not thought necessary to begin the operation anew. Repeated applications of the nitrate of silver at different times completed the cure at the end of a few weeks. M. Roux thought the twisted preferable to the plain suture. In order to stimulate the edges of the fistula he employed pincers or forceps ending in a semi-eliptical flat surface or plate, very much like the disk of a pair of tongs, one of the halves of which had been removed. When once the lips of the wound were seized by this instrument, M. Roux easily cut it away with a straight bistoury, and could have done it equally well with a pair of long scissors. The stitch was first passed from the vagina through the left edge of the wound into the bladder by means of a curved needle and the instrument usual for conveying it. This needle was then drawn out from the bladder into the vagina through the other side of the fistulous opening; then withdrawn, carrying with it into the two lips of the wound a little metallic pin fastened to the end of the string. Three others were afterwards inserted with similar precautions, after which a loop of one suture, carried over the first, and crossed over each of the fixed pins successively turn by turn as is done in the operation for harelip, brought about an approximation of the cut surfaces, and completed the twisted suture. Symptoms of intermittent fever, and subsequently of functional derangement of the brain, and inflammation of the peritoneum and pleura began in a few days to manifest themselves, and increased to such a degree as on the 12th to destroy the patient. On opening her body the fistulous opening was found very much enlarged, between the edges of which not the slightest union had been effected at any part. But, as M. Roux very judiciously observed, since an intervening acute phlegmasia almost always arrests the progress of cicatrization in

wounds, and even causes it to retrograde when once began, it would be unfair to conclude from the failure in this that the twisted suture was not adapted to any case of vesico-vaginal fistula. The method followed by M. Schrœger, though less ingenious, had notwithstanding a more fortunate issue. Still it cannot be said to have been crowned with complete success; suture was thrice practised, and the words of the author himself are proof that the patient did not get entirely well even after the third time. "I convinced myself," says he, "that the wound was all healed but about the space of one line—of which it had been difficult to pare off the edges. The patient was much relieved, and I was in hopes of being able to conduct her case to a perfect cure on a fourth application of the sutures; when indispensable business compelled her to leave Erlangen."

M. Duges's patient was rather injured than benefited by the suture. A young girl, who was in my department at La Pitie for a long while, submitted to the operation, which was performed by M. Robouham; but according to what I was told by M. Mondiere, who was a witness to it, unattended with any marked benefit. It would be useless in me therefore to detail the steps of their respective proceedings. Unless the fistula is extremely wide it is not possible to hook in the index-finger on one edge as was done by the surgeon at Bologna, nor to seize it with the tong-shaped forceps used by M. Roux. A longitudinal division alone would answer for the insertion of a suture after the manner of these two surgeons. Now it is well known that vesico-vaginal fistulæ are for the most part transverse or semilunar slits, with an anterior concavity between the urethra and the entrance of the ureters into the bladder. But for the too great complexity of M. Nœgele's apparatus it would assuredly offer a much better chance of success than the preceding ones, although little better suited than they to any but longitudinal openings. We must have some more simple contrivance before suture can be generally adopted. M. Schrœger had reason to congratulate himself on so nearly curing his patient, and on obtaining so happy a result from his three trials, considering that he only inflamed the posterior half of the fistula, and that he passed in his stitches a line or two from the cut edges. Experiments which I have made on the dead body lead me to believe that we might succeed better in the following way. I place the patient on a bed or table properly covered, and of a convenient height. A mattress rolled up is placed under the abdomen, upon which the woman lies, by which the thighs may be flexed whilst in this position. An assistant keeps the vagina open by means of a wide tube (*gouttiere*) of metal or thin wood. With one cut of straight scissors I enlarge the fistula backwards for a line or two, do the same to its anterior angle with a straight bistoury, so as successively to lay hold of each lip with a good staphyloraphe forceps, and cut away its edge either with straight scissors or scissors a little curved on their flat surface. The sutures are then put in three or four lines without the stimulated edges. The forceps answer instead of the finger and thumb to hold the parts while it is being transfixed with small needles in the way that is done by MM. Roux and Malagodi. Every thread is knotted with the fingers at the bottom of the vagina. If the orifice be a transverse one, a bistoury curved on its flat side near its point, and very sharp, carried into the vagina will answer for detracting a selvege

or border off of its deep edge kept turned over in another direction, or drawn down by the assistance of a hook and good forceps.

Procedure of M. Lewziski.—Convinced of the difficulties I have pointed out, several surgeons have turned their attention to another method of treatment. It was natural that as a first principle, the mind should be pleased with the idea of bringing back the posterior edge of the fistula towards the urethra, while the anterior edge was to be turned backwards at the same time. In a thesis defended in 1802 before the faculty at Paris, M. J. J. Lewziski endeavored to establish the practice. The instrument which he recommends is a flat sound slightly curved, pierced with two holes at its point for the passage of a needle also curved. A stem or spring enclosed in this canula is employed to push out the needle into the vagina through the posterior lip of the fistula when the instrument is once passed into the bladder. When drawn out at the vulva, the needle drags along with it a thread of which a loop or stitch is made. After several are placed in the same manner, they are all closed in a knot-tightener to close the vesico-vaginal aperture.

*Sounds. Pinces Erignes, or Crotchet Forceps.**—In 1826, M. Lallemand published a case of long standing vesico-vaginal fistula, cured by means of an instrument somewhat analagous to that of M. Lewziski. The apparatus of the professor of Montpelier is, in fact, composed of 1st, a large canula about four inches long; 2d, a double hook which is made to move by a stem within the principal instrument, so as to be pushed out and drawn easily back again into its sheath; 3d, of a circular plate attached to the other end of the canula or sound, which in case of need would prevent it from penetrating too deeply into the urethra; 4th, of a twisted spring (*en boudin*), designed to draw forward the little hooks when once engaged in the posterior lip of the fistula. Its application is similar to that which I described in speaking of the contrivance of M. Lewziski. The sound being passed into the bladder, allows the hooks to be pushed even into the vagina through the vesico-vaginal septum, which it is the business of the left index finger to sustain. By the turn of a screw they remain fixed in this position. A ball of lint or of fine linen is then placed, so as to protect the tissues, between the forepart of the urethra and the outer plate of the sound; lastly, the spring is loosed, which thence forward acts simultaneously by pulling on the posterior lip of the wound through the medium of the hooks, and by crowding back the inferior wall of the urethra by means of the circular plate, or of the lint which serves as a fulcrum for it. By means of mechanism, which it would require too much time to describe, the trigger of the spring may be graduated so as to produce a moderate pressure only, but which, however, is sufficient to bring the two edges of the opening in contact. For three days M. Lallemand was flattered with hopes of complete success. On the fourth, a few drops of urine having escaped per vaginam, it became necessary to remove the instrument, on the inferior surface of which, four lines in advance of the hooks, a small blackish

* The translator not being acquainted with any English word, which expresses this species of forceps, begs leave to subjoin the meaning of the word *erigne*, that the nature of the instrument may be better understood. It is a curved hook, used by surgeons to remove parts difficult to be taken hold of, and to facilitate their extirpation. They are either single or double; and are made with the hooks at one or both extremities. Perhaps the word *crotchet forceps* will convey the idea. The word *sonde*, in French signifies equally a catheter, a probe, and a sound.—TRANSLATOR.

brown spot was observable. The fistula, however, appeared to be considerably diminished in extent. A new application of the crotchet sound was attempted; and this time the adhesion appeared complete. However, some imprudence which was committed in about ten days again gave rise to a flow of urine through the vagina. A very small separation only had occurred, and the surgeon thought it possible to complete by caustic the cure which his instrument had so far advanced. He was written to sometime afterwards, that nothing passed any longer through the fistula, and that the recovery seemed to be complete. Still, as M. Lallemand does not assert that the cicatrization of the fistula in this case was perfect, the result is left somewhat doubtful. Some persons who think themselves well informed about it, are positive that the patient relapsed into her former condition, and that she came to Paris to consult other medical practitioners on her case. Besides, as the operation began and ended with the application of the nitras. argenti. and as this article alone has in many cases lately been incontestably successful, the statement is really very far from being as conclusive as at first sight it might be supposed. An attempt of the same kind was made with this instrument during the year 1829, at the hospital Beaujon. In it, likewise, the hopes of success which once were entertained were not realized; and ere long the patient was as much afflicted as she had been before. The inventor himself seems to have been equally frustrated in two attempts which he has since made.

The instrument invented by M. Dupuytren, and which he once used with success, is a kind of large canula or female sound, which has on its sides two little operculi, or guards (*onglets*), which open like wings, or shut entirely, according as a central stem, shaped like a spring, is drawn out or pushed in, which controls their motions. It is introduced closed into the bladder. The operculi once separated and fixed, it is drawn towards the operator as if he was about to remove the whole; by preventing it from entering the urethra, the guards cause it to carry forward along with it the posterior lip of the fistula, while some lint or linen, placed between the meatus urinarius and the external plate of the canula, allows it to crowd back the urethra and anterior lip of the fistula. This proceeding, which is not attended with the inconveniences either of tearing or perforating the vesico-vaginal septum, would certainly claim an undoubted preference over every other, were it really capable of perfecting a complete co-aptation of the edges of the fistula; but this is not the case, and I fear that it can be considered only in the light of an adjuvant to the use of caustic, in itself so very effectual.

Procedure of M. Laugier.—If the suture is applicable only to the longitudinal fistula, it is evident that transverse ones alone are suitable to the use of the crotchet sound. With a view to obviate this difficulty I adopt the method of M. Lallemand to fistula of every sort. M. Laugier constructed a crotchet forceps, jointed like one of Smellie's forceps, whose form depends upon the shape of the fistula. If it be for a transverse one, the claws of the instrument are merely bent on one of its surfaces, so as to be placed one on the right and one on the left side, and to look directly upwards. On the contrary, when for a longitudinal fistula, the two crotchets of each claw must be parallel to the axis of the body, and the end which sustains them bent on the edge. The forceps, lastly, should be bent more or less obliquely if the fistula should happen to assume an intermediate direction. The crotchets of

this instrument ought to be very short, says M. Laugier, that they may not pass through and through the vesico-vaginal septum. They are inserted from within the vagina, and not the bladder. One branch is first carried some lines outside the fistula previously stimulated; the other is then applied similarly on the other side; after which they are approximated by locking the forceps. To graduate the strength of this approximation, and at pleasure to increase or lessen its power, a screw crosses the two handles of the instrument, very much as it does in the enterotome of M. Dupuytren. The whole is protected by lint properly disposed within the vagina, or at least at its orifice.

This plan of M. Laugier's has never yet been practised on the living female, and though a very ingenious combination, I have my doubts of its being of any considerable efficacy. It is difficult to understand how, upon a part so mobile, hooks can be so fastened for three or four days together, as to keep the lips of a tolerably wide fistula in adequate approximation. Unless they pass through the whole thickness of parts, they will slip almost inevitably, tearing with them the vaginal tunic, or else the urine will settle into the depression left in the bladder, and not fail to find its way out by the sides of the instrument. Suppose them to press into the bladder, would not their passage, which would be enlarged by subsequent suppuration before they could be withdrawn, be likely to create new fistula rather than to heal the former one? Besides, to use them the outline of vesico-vaginal fistula should offer at each point the same thickness. Now those which are incomparably the most common, which occupy the end of the bas-fond of the bladder, generally have the side near the urethra exceedingly thick, and the posterior side on the contrary very thin. Consequently the anterior claw of the instrument ought to penetrate to a depth of two or three lines, while the other would be fixed in a tissue of a line, or a line and a half only in thickness. In longitudinal fistula his hooks would probably effect a partial union only, insomuch as their edges offer almost always spots of various resistance. Lastly, for deeper-seated fistulæ would not sutures be a more certain measure, and would its adoption be attended with greater difficulty than this?

Cauterization.—This, which at first blush might not be supposed very likely to act otherwise than by creating additional loss of substance, is nevertheless one of the best methods which have hitherto been resorted to. When pushed far enough actively to inflame without producing mortification of the tissues, it induces swelling and intumescence, which contracts and closes, for the time at least, the aperture which we are desirous of obliterating. After the subsidence of this engorgement the exudation and the suppuration of parts is attended with manifest disposition to contraction. It is a method therefore which deserves from the practitioner the utmost attention, and is particularly likely to suffice in cases in which the opening is not of any considerable extent. It may be effected either with the actual cautery, or with the nitrate of silver, the concentrated acids, and that of the acid nitrate of mercury, of which M. Dupuytren at first thought, should be laid aside. The red hot iron has the advantage of being most rapid and energetic in its action. Unfortunately it is disposed to form sloughs, and destroy the tissues, which it is requisite merely to inflame. The nitrate of silver is generally preferable; and the actual cautery should supersede it only in particular cases; for example, such as exceeding callosity of edges, which it is impossible to irritate.

The red hot iron being decided upon a speculum [illegible]. The common speculum "trise" is as good as any other. However, for more perfectly protecting the adjacent parts, and to leave nothing exposed but the fistula, we may use a simple cylindrical speculum pierced on one side. It is scarcely necessary for me to say that the modifications invented by M. Dubois, M. Erhmann, &c., whilst they certainly answer the end in view, are really quite unnecessary. Having introduced this instrument so that the fistula can be seen, we next carry a stylet at a white heat, or a small bean-shaped cautery iron, into the aperture, being cautious to leave it there for an instant only, and repeat the cauterization if the first application be not sufficiently active. M. Delpech, who has been remarkably successful with it, thinks that the cautery should act only on the vaginal side of the opening, and not on the vesical; to save, as he says, loss of substance, and also to bring forcibly into play the power of contraction; a remark which should be borne in mind in any subsequent attempt which may be made.

The speculum is never indispensable when nitrate of silver is employed. A *porte-crayon* ought never to be used in cauterizing with this substance. It then scarcely touches any thing but the internal surface of the vagina, leaving the fistula most commonly wholly untouched. To the end of a common pair of dressing forceps a piece of the nitrate is fastened by a thread so as to project at a right angle from the blades. With this contrivance nothing is easier than to introduce the caustic into the interior of the fistula, and apply it all around its circumference; a ring with a little beak for receiving the caustic, conducted by the extremity of a finger covered with a leather stall, would do as well as the forceps. However the operation of cauterization may have been performed, it is proper to throw up repeated injections into the vagina, and afterwards to place the patient in a bath. A catheter is to be left in the bladder, and to remain open at the edge of some utensil placed for the purpose before the vulva, that the urine may escape easily.

The operation is to be repeated after pain and swelling have subsided. It may be recurred to four, five, or six times, according to the benefit derived, until the urine have ceased altogether to flow through the vagina. It would be wrong to suppose, that after a fistula is reduced to a very small diameter, and seems no longer to improve or contract, it will fail of complete success; we need not despair, for in numerous instances it will close at the end of some weeks although the progress of recovery had appeared to be suspended for ever. M. Dupuytren seems to have had considerable success by cauterization either with the actual cautery, or by the use of chemical agents. The cases are mentioned by M. Sanson, who was an eye witness to them. Attentive perusal of the case published by M. Malagodi induces the belief that in this patient also the caustic did more for the cure than the suture; and in the other cases in which caustic has been used as accessory, or was combined with means which were considered as of principal utility, it is very possible that it alone may have produced the results spoken of.

The oldest method, that which alone is mentioned by M. Boyer, and the only one which is proper when a radical cure is not attempted, is the method of Desault. It consists in fastening a catheter permanently in the bladder, whilst a cylinder of lint, linen, or better yet of gumelastic, is retained in the vagina, moderately to stretch the angles of the wound.

Desault and Chopart who were for a long time embarrassed by the difficulty of preserving this catheter immovable, at length succeeded in discovering the means of doing so. Instead of a double T bandage, on which were attached the ribands fastened to the extremity of the instrument; instead of uniting these ribands with the hairs of the vulva, these authors contrived a sort of truss, the cushion of which came up on the mons veneris, and which had at this spot a metallic plate, bent like a bow, which is made to descend at pleasure over the forepart of the pudendum, and is perforated at its end to receive the catheter. But it seems an unnecessarily complicated contrivance, which has no more advantage or steadiness than the linen apparatus employed by others. Desault and Chopart assert that they have cured several women with it, and quote one case in particular. Still in this case they leave room for doubt, by saying that the woman appeared to be cured, and not formally asserting that she was cured. Months, and even years sometimes must elapse for a perfect cure to be obtained in this way, and is it not fair to suppose that the fistula during this time may have got spontaneously well, as has occurred under other circumstances when no treatment was practised?

If notwithstanding it is wished to trust to the catheter permanently inserted, it seems proper at least to do away with the foreign body placed after the manner of Desault in the vagina. This, by dilating the canal, must oppose a natural obstacle to the contraction of the fistula. In such case an egg-shaped gumelastic ball, however, would be the best thing to try.

If it is admitted that the fistula is of an incurable nature, all that art can do is to recommend measures of cleanliness; the object of which is to protect the organs against the acridity of the urine, or to receive this fluid in such a way as that it may inconvenience the patient as little as possible. For this end, J. L. Petit had constructed an instrument which he called the "hole of hell" (*trou d'enfer*), and which if we believe his representation answered perfectly; but as he has not described it, it has not been possible to benefit by it since his time. Fortunately that of Feburier, which is to be had at most manufacturers of gum elastic, leaves on this head nothing to be desired. It is a sort of basin of caoutchouc which may be worn at the vulva, and is prolonged into the vagina; and does not interfere with the woman's walking, or prevent her following her customary avocations. Mr. Barnes, who in consequence of the frequency of vesico-vaginal fistula among English women, has had to treat them a number of times, uses a long bottle of elastic gum, which may be introduced into the vagina, and which has on its anterior surface an aperture in which a sponge is fixed, and which is placed towards the fistula, so that the urine may enter it little at a time. The patient is to withdraw it twice or three times a day, squeeze out the fluid by simple pressure, which by reacting on the sponge completely empties the instrument.

If neither of these instruments can be procured, the only resource which remains for the woman is to supply their absence by means of fine sponges, pieces of linen, or silk paper, which are to be changed more or less often every day,

A plan has recently been suggested by M. Charilly, of causing the patient to lie semiflexed on her abdomen; with a view to compel the urine to flow

out, either through the urethra, the catheter, or a syphon, which might be placed there and prevent it from gravitating towards the fistula; but it has the great objection of failing in its object. Neither could it be endured by most women for more than a day or two. MM. Sanson and Schrœger have tried it for a good while, have derived no benefit from it, and have been compelled to abandon it by the dread of eschars on the knees, and elbows, and spines of the ilia, from long continued pressure.

Art. 12.—*Recto-vaginal fistula.*

The posterior surface of the vagina is like the anterior, liable to be lacerated during delivery; to be compressed by the child's head, or the branches of the forceps; to perforation for gangrene, &c. No operation is necessary when the solution of continuity comprises only the perineum, so as to produce an increased size of the vulva; neither is it called for when the perineum is perforated by the head, elbow, or an inferior extremity of the fœtus, provided the posterior commissure of the vagina and sphincter ani remain unhurt. It is uncommon for such injuries to have any bad consequences, and recovery in general ensues without any special treatment. But when the laceration extends further than this, trenches on the recto-vaginal septum fairly, or when the sphincter ani is torn through, the aid of surgery is required. The passage of the greater part of the fecal excretions through the vagina, render it so disgusting an affection, that it is impossible to avoid seeking relief from its continuance. The same may be said of those cases in which the recto-vaginal septum is perforated or split up above the sphincter ani which remains entire, and with or without laceration of the perineum. Though not very uncommon, this fistula is not as often seen as vesico-vaginal fistulæ are; doubtless, because the head of the child, or the instruments which accoucheurs are occasionally obliged to employ, by rubbing against the parts behind the pubis, compress the bladder in a more limited space, and on a spot more salient and irregular than is done on the rectum behind. As they have moreover a greater tendency to disappear spontaneously than such as occur in the vesico-vaginal floor, it is very natural that they should have been much and generally neglected. Ruysch mentions a woman who had one in the recto-vaginal septum as large as the thumb, which healed without any operation. A fact nearly similar was mentioned in 1829, by M. Phillippe de Mortagne. The patient of whom he speaks had an enormous perforation which caused a communication of the rectum and the vagina. The most celebrated surgeons in the metropolis were consulted on the case; they all replied that she would probably remain incurable, and that they saw no operation which they could advise to be attempted. Laying his patient on her side, and adopting measures of cleanliness, constituted the whole of M. Phillippe's treatment. After enlarging considerably, the fistula began to contract, so surely that it was completely closed in a few months. The cure, when the case was published, was still perfect, no apprehensions seemed warranted of a relapse. An analagous case had been published by Sedillot, differing only in so much as that it was of that kind which Smellie in vain endeavored to cure, and over which M. Noel triumphed by using the twisted suture. Unfortunately the

organism will not always lend herself to the wishes of the practitioner, and it is but too common to see lacerations in this situation continue to defy the best directed efforts of medical art.

As to the operations to be attempted two different species of this disease are to be met with. In the one there exists a pure and simple fistula, that is, perforation, of greater or less extent, in some one part of the recto-vaginal septum. In the other the laceration comprises at once the sphincter ani, and the whole, or a part of the perineum. If the perineum is completely torn through, it resembles in some sort a harelip. If torn only at its posterior point, the wound after the lapse of some time, cicatrizes at this point, and the case becomes one of the first kind, in which there is mere fistula of the septum properly so called. To all these cases the means advised for the treatment of vesico-vaginal fistulæ, are applicable also. Cauterization, for example, seems often to cure them when they present themselves under the form of a harelip fissure. In fact, it is generally admitted, that by stimulating in any way the angles of such a separation, it rarely fails to effect union between them, at least for an extent of some lines. To try the effect of the nitras argenti, on this principle, it is only necessary to apply it each time to the farthest portion, or commissure of the solution of continuity. Fistulæ, properly so called, will not, indeed, yield so readily, unless very small; to them, when very large, it would be useless almost to attempt the application of caustic, particularly as the crotchet forceps of M. Laugier will furnish us probably with a much more efficacious resource. A young woman, who had had it for eight months, was recently cured of one in fifteen days in my department at La Pitie, by the use of port wine injections.

Suture.—The operation which first presented itself as suitable for recto-vaginal fistula, and which at the first glance seems to offer most certainty, is suture. It is only to be regretted that it is so difficult of application; and that, thus far, very few cases can be cited in favor of it. M. Gardien tells us that it was vainly attempted by M. Dubois; and M. Boyer says, that if every case in which it had failed had been published, the number known would now be very considerable; so that he scarce dares advise its performance. Still, it has succeeded; and it is probable that in the end, as it is rendered more perfect, greater benefit will be derived from it. I therefore think that in most cases it should be tried.

The first cure known to have been produced by it, is that mentioned by Saucerotte. The patient labored simultaneously under laceration of the perineum in front of the anus, and perforation of the recto-vaginal septum above the sphincter.

The operation was thus performed: the surgeon distended the vagina with a double branch speculum, and passed in at the anus, up the rectum, a species of wooden director (*gorgerette, gorget*), the convexity of which he placed under the fistula to serve as a fulcrum on which his other instruments were to move. Having thus gained sight of the aperture, Saucerotte cut away its edges, partly with a bistoury wrapped round with linen, partly with a kind of cutting scraper (*rugine*). The furrier's, or uninterrupted stitch which he preferred, was applied by means of two crooked needles, one shorter than the other to begin with, and the longer one for the last. The forceps, or common needleholder, had been altered a little for the occasion; that is to say, its

extremity had been so arranged as to allow of the needles being fixed in it in any direction. M. Saucerotte then carried the first stitch up, with this instrument, to the level of the upper angle of the irritated fistula, where he confined his ligature by a piece of diachylon plaster, so as not to be obliged to make a knot in it. Then, with another needle, he made six spiral or overcast turns of the suture, going from behind forwards, which he fastened firmly, by tying either half of his thread on some foreign body. During several days, he had reason to expect a cure would follow; but the woman who had had no alvine discharge, was ultimately obliged to strain so violently to expel the hardened, scybalous, fecal matters which had accumulated in the rectum, that the suture gave way, and the larger part of the feces escaped per vaginam. However, M. Saucerotte perceiving that the adhesion was still perfect at the upper part of the fistula, and the woman being herself anxious for the reperformance of the operation, renewed his attempt after the lapse of a month. This time he was cautious to divide the frenum formed by the sphincter, so that nothing could interfere with the fecal discharges; and his success was perfect. M. Noel has likewise performed this operation of suture, in a case very analogous to that of Saucerotte. The woman had, during a painful labor, suffered laceration of the whole perineum, anus, and a part of the septum. He employed scissors, to reanimate the edges of this old separation of parts; placed his two needles, one at the level of the sphincter, the other an inch higher up; fastened them by the aid of threads to form the twisted suture; then closed the woman's thighs, and encircled them with a few turns of a bandage, which surrounded them both; enjoined her to lay on her back, that the feces in escaping might follow the posterior wall of the rectum; and after the removal of this second needle, became satisfied of the complete union effected between the sides of the fissure at this point, but also in the whole upper extent of the laceration, in which no stitches had been put, and the lips of which had been approximated only as a consequence of the closure of the lower portion. This happy result, which was not interrupted, is a proof, that if Smellie in his cases had been more methodical in his proceeding he would probably have been equally fortunate. In a case which has recently been published by Mr. J. Nicol, in England, the operator was thrice obliged to return to the suture; and he likewise completely succeeded in his attempt.

Another species, the *entero-vaginal* fistula, has likewise engaged the anxious attention of surgeons. A knuckle of the intestinum gracilis, the iliac sigmoid flexure of the colon, getting into the recto-uterine cavity, may by perforating it, ultimately make its way through the upper and back part of the vagina; as in one case was known by Roux, and in another by M. Caza-Mayor. Two very different operations, both in proceeding and in result, were invented to remedy this species of affection, which becomes a sort of artificial anus. M. Roux's patient, a young woman, who had had the fistula for several years, entered La Charite determined to be freed from it, cost what it might. The surgeon thought it possible to cure it by seeking the intestine through the abdominal parietes. His intention, which has been modified in later years, was to separate the end of the ileum from the vagina first, then invaginate it with the lower end of the colon, and thus by means of stitches, re-establish the continuousness of the digestive canal. Never was

bold attempt followed by more disastrous results. The woman died, and on inspection of the corpse it was seen that the part of the intestine which should have been placed downwards, was inserted in an opposite direction! That of M. Caza-Mayor though to appearance more rational, and less dangerous, did not completely succeed either; the patient dying suddenly of a pneumonia, at the very time when the surgeon was in hopes of seeing his attempt crowned with complete success. The instrument which he made use of resembles in its principle the enterotome of M. Dupuytren. It is a kind of forceps, each blade of which ends in an oval plate or surface, eight lines long by four wide; slightly grooved on the intestinal surface to admit corresponding elevations. One branch being introduced into the vagina by the fistula as far as into the perforated organ, the other into the rectum to the level of the first, the oval surfaces come together, bringing into contact the corresponding sides of the two portions of intestine, so as to produce at the point of junction a loss of substance, from the absorption of the intervening septum the result of the compression thus effected. The forceps altogether is about eight inches long; its branches being jointed in the usual way, leave between them a space sufficient to contain the entero-vaginal septum and the perineum; while a screw which crosses the handles at their base allows of their action being graduated at pleasure. Things happened in this case as the operator had anticipated.* The fecal matters partially resumed their natural route, and every thing led to the belief that the fistula in the vagina would have closed ere long, when the patient perished, the victim of her own imprudence. The whole result is doubtless very encouraging; it is only to be feared that the results will not all be equally so. It is easily conceivable that when a hole is effected in the rectum artificially, feces may in a measure pass through it; but how is the vaginal orifice to avoid receiving some intestinal matter, and how is it to be obliterated? The error made by M. Roux in his operation, in nowise effects the project of proceeding by the failure of the attempt; the conception remains what it was before.

When fistulæ, opening into the vagina are very near the vulva, they are in general easily cured if treated like fistula in ano. Two examples were gleaned at La Charite, in 1829, and I was myself successful by the method, in the case of a woman 39 years old. operated on at La Pitie in the month of January last.

Art. 13.—*Dystokia—Difficult Delivery.*

Operations which are sometimes required for the extraction of the child, have in every age been the subject of a separate branch of medical science; and can only be discussed with propriety in works upon obstetrics. It would here be superfluous for me to enter into all the details which they admit of, yet as there are among them some which ought not wholly to be omitted, I proceed briefly to describe the steps in their execution.

Symphyseotomy.—Fernel, Pineau, and several of the older authors, impressed with the belief that the articulations, and even the bones of the pelvis are susceptible of softening during pregnancy, imagined that benefit would

* The instrument, which was removed on the fifth or sixth day, brought with it on one of its flat surfaces, the double intestinal layer, sloughed off.

result from promoting this relaxation in cases of narrowness of the pelvis; and this might be effected by means of embrocations, poultices, and general and topical bathing. Certain of our modern writers, proceeding on the vulgar traditions spoken of by Riolan and Pare, which assures the people that among many nations it is customary to fracture the pelvis of little girls soon after birth, to facilitate in them the process of parturition; and likewise on the saying of Galen, when on the subject of the pelvis: "non tantum dilatari, sed et secari tuto possunt ut internis succurratur," have supposed that this section of the symphysis must have been known from the very remotest antiquity. Certainly, Lacourvee, who wrote in 1655, does mention a mis-shapen woman who died before delivery; and in whose dead body he separated the pubic symphysis, with the intention of enlarging the pelvis; it is true, likewise, that Plenks, in 1766, did the same thing upon another individual. But it is as certain notwithstanding, that to no one had it ever occurred to propose it formally as an operation practicable on the living female, until Sigault, then only a student, made it the subject of a paper which he read before the Academy of Surgery in 1768. It is the only safe means which can be resorted to of preserving the child, under these circumstances; 1st, where its head is strongly impacted in the upper strait, or below it; 2d, when the head having passed the abdominal strait, is arrested by the contraction of the perineal circle: 3d, when the trunk being delivered, the head remains behind in the pelvic cavity. In these cases it is preferable, even after the death of the mother, to the Cesarian section, for it would be nearly impossible to remove the fœtus alive through the incision in the abdomen.

Method of Operation.—The patient being placed upon an operating table, or upon a bed, in the manner adopted for applying the forceps, is to have the lower limbs slightly flexed and held asunder at a proper distance; one assistant supports her shoulders, two others take possession of the knees; a fourth makes tense the integuments over the abomen, and a fifth is selected to hand the instruments to the operator as he requires them. The surgeon seated or standing up, or to the right of the patient, or between her legs, armed with a convex bistoury, makes an incision which is to commence a little above the symphysis, and be continued as far as the upper surface of the clitoris. The integuments, previously shaved, and all the soft parts of the mons veneris, are divided by this cut, which is parallel to the axis of the body, and as nearly as possible in the centre of the articulation. It is well however, in coming to the lower part, to incline the incision a little to one side between the summits of the labii majus and minus, and also to separate one of the roots of the clitoris from the ramus pubis in order to avoid afterwards any dangerous laceration. The arteries to be tied can be but very small ones, unless the internal pudic have been divided by an incautious prolongation of the section into the parts below. Some have advised, that to divide the cartilage we should proceed from below upwards; others from above downwards; many from behind forwards, or from within outwards; but the majority recommend that it should be done from before backwards. To effect this, a bistoury, a scalpel of a shield-like shape (*en rondache*), the flexible knife of Aitken, a bistoury with a small button at its extremity, or a common bistoury, the point of which M. Gardien thinks should be protected from causing internal organic lesions by the nail of the left index finger, have been employed.

None will dispute the right of every one in such a case to choose for himself the instrument to which he is most partial. For my own part I think that in this, as in every other case, it is to the hand, and not to the instrument that regard is to be had; and that the only requisite about the knife is that it be solid, and very sharp. The surest way is to divide the cartilage from above downwards, and from the cutaneous towards the pelvic surface of the symphysis. The incision should be extended upward for half an inch or an inch on the linea alba, to avoid injuring the bladder or urethra; for it has happened that surgeons at one stroke have gone through both bladder and uterus down to the head of the fœtus. It will always be enough to hold the bistoury at a few lines from its point with the first two fingers of the left hand, whilst the cutting is done with the right. The previous introduction of a catheter will also obviate this risk; or if not beforehand, at least just before beginning the second stage of the operation. The bladder is thus emptied, and then the catheter serves to draw the urethra gently to the right, whilst the incision of the sub-pubic ligament is slightly inclined to the left. The ligamentous tissue once divided, increased precaution is necessary; the cutting is done rather by scratching with the point of the bistoury, which is to be laid aside so soon as nothing more that is firm or elastic remains to be cut through. Should it so happen that the cartilage is found to be ossified, there would be so little chance of obtaining any considerable increase of room, except by sawing through the articulation as was done by Siebold, that I should prefer to have recourse to the Cesarian section. If the plan of Desgranges of applying the saw beyond the symphysis pubis upon the body of the bone be practised, the operation would be equally dangerous, for it is in the sacro-iliac symphysis, and not in front, that the difficulty is experienced. No sooner is the separation of the symphysis effected than the posterior branch of the curved lever, formed by the os innominatum drawn backwards by its posterior ligaments, produces a separation of six or twelve lines between the ossa-pubis; the extent of which will vary according to the degree of contraction in the pelvis, and that of the consistence or softening of the cartilages. Though it is sometimes effected equally at the expense of both bones, it must also sometimes depend much more upon one bone than on the other. Be this as it may, I can scarcely believe it possible that it can of itself grow to such a degree as to become dangerous; and that it can be needful to guard against this by confining the hips before the end of the operation, as has been recommended. On the contrary it is almost always necessary to press upon the spines of the ilia from before backwards, and from within outwards, with slowness and in moderation; or else to separate the thighs of the female tenderly to carry it to a sufficient extent.

The delivery being effected, the surgeon wipes the parts, approximates the pubes one to the other, covers the wound with a rag spread with cerate, some lint, and a compress, all kept on by means of a bandage round the body applied sufficiently tight as at least partially to oppose any fresh separation of the joint. The patient is to lie on her back in a state of perfect immobility. The thighs at least are in need of the most absolute repose for six weeks or two months, which is the time requisite for the reconsolidation of the symphysis. She is moreover to be restricted to the regimen suitable after serious operations; and the untoward symptoms, if any, which arise are to be met and

treated with promptitude and energy. As the time for recovery draws near, walking and motion are to be allowed with the utmost limitation; if there be still pain, and a degree of mobility in the pelvis, the state of rest is for a certain time to be resumed. Nothing undoubtedly can be more desirable than consolidation in the divided symphysis; but women, in whom it could not be effected, have nevertheless been able to walk, stand upright, and even to leap, without any sensible inconvenience; a peculiarity explicable only by supposing an acquisition of greater solidity in the posterior articulations. MM. A. Leroy and Lescure go so far even as to say that this should be encouraged by dispensing with the bandage round the pelvis; they assert, and perhaps not entirely erroneously, that the interpubic space becomes filled up with cellulo-fibrous tissue, which detracts nothing from the resistance of the articulations, and which in the end would have the effect of causing the woman to lie-in with the greater facility.

The few advantages of, and great danger in symphyseotomy are now so fully established that it is seldom performed; and it is really a sort of event in surgery that M. Stork should have had a successful issue from it in 1829. Upon the whole, when it is considered that of forty-three women on whom it has been performed, fourteen have died; that many have remained cripples for life, and particularly the two operated on at La Maternite, of whom Mdme. Lachapelle speaks: that in many it was not indispensable, for as may be seen in the work of Baudelocque, they would have been delivered at a later period; that in most of the cases the fœtus has not survived, and that in fact it must perish in most of the cases, owing to turning being performed, or to the use of forceps, which it is almost always necessary to attempt; lastly, that as Lauverjat has said, out of eighteen operations twenty-one persons, mothers and children have lost their lives; that in two cases it has been necessary to recur to the Cesarian section; that five have been followed by incontinence of urine, and one by limping; that in thirty-four cases spoken of by Baudelocque, only eleven children were saved; when I say these dangers are considered, and fairly weighed against the advantages gained even in the happiest termination of the proceeding, it is difficult to avoid siding with Desormeaux in the conclusion that section of the pubis is not less serious than the Cesarian operation, and that its use must be restricted to very narrow limits indeed.

Procedure of M. Catolica.—If I rightly understood what was said to me by Professor Vulpes, it would appear that Dr. Catolica of Naples has substituted for symphyseotomy another operation, which strictly speaking is merely a modification of that already proposed by Desgranges of Lyons. Instead of dividing the cartilage, he advises a section of the body and ramus of the pubis on either side, to be made between the sub-pubic or thyroid foramina, as formerly proposed by Aitken. Thus the sacro-iliac symphysis would remain unharmed; no danger of wounding either the bladder nor urethra is incurred; the cellular tissue of the pelvis is scarcely disturbed; consolidation is easily effected; no abscess, no caries, no fistula, no limping, no peritonitis is to be feared; and a considerable increase of the sacro-pubic diameter obtained notwithstanding. I know not enough of the reasoning of the author of the plan to warrant me in condemning or approving of it; and shall rest satisfied with this brief statement until I become possessed of more

ample information. I shall only say that some experiment on the dead body, and some attempts made by Mr. Ashmead, lead me at first sight not wholly to reject the idea of the professor at Naples.

Abdominal Uterotomia.—Cesarian Operation.—Hysterotomia.—Hysterotomokia.—Cesarian Delivery.—Gastro-hysterotomia.

The name Cesarian section is given to the opening made in the female abdomen and uterus, for the purpose of removing thence the fœtus when incapable of passing *per vias naturales.* It has been extended also since the time of Simon to the incision or incisions which it sometimes becomes necessary to make in the neck of the uterus, with a view of facilitating the passage of the head of the child.

Historical.—Lost, as it were, in the darkness of ages, the history of this operation none have thus far been able to trace. In the fabulous periods we are told that an infant, the child of Jupiter, was taken by Mercury from the womb of Semele, his mother. The Romans said the same of Esculapius, who was taken from his mother by Apollo whilst she lay upon the funeral pile which was soon to consume her. Lycus, we are told by Virgil, came thus into the world. These vague traditions, a passage in Pliny, and some edicts of the Roman law, lead to the belief that the Cesarian section was in use in very remote ages. In a work by Mr. Mansfield, of which an extract may be found in the Bulletin des Sciences, the author has attempted to prove that it was practised also by the Jews. It is stated in the Talmud, and in the Mischajoth, that a child born by a section of the belly enjoys none of the rights of primogeniture. Jaschi has described it in his commentary on the Nidda, and asserts that women on whom it had been performed were not liable to the forty-days' purifying.

Nothing however exists to prove at all authentically that it was ever practised on the living subject before the year 1520, unless the case of a certain lady of Craon, who, according to Goulin, submitted to the section of the abdomen in 1424, and with her child survived it, be admitted as accurate. The ancient Greek and Latin physicians in no way allude to it. Guy de Chauliac, proceeding on that passage of Pliny which follows, seems first to have described it. "Auspicatus, enecta parente, gignuntur, sunt Scipio Africanus, prior natus, priusque Cæsus, Cæso matris utero, dictus, qua de causa, Cæsariis appellati, simile modo natus est Manlius qui Carthaginem cum exercitu intravit;" and he seems to think it derived its name from Julius Cesar. Others, on the contrary, contend that it was from the operation that this person and his family derived the appellation. Bayle however has noticed that since the mother of Cesar, Aurelia, was living when her son invaded Britain, the account given by Pliny must be rejected as fabulous. The researches of Weidmann and Sprengel having failed to throw any additional light on the subject, we can only admit the etymology of the Cesarian section to be no better known than its origin.

According to M. Baudelocque himself, the Cesarian section has been twenty-four times practiced with success since 1750 up to the beginning of the present century; since which time, exclusive of too cases not admitting of any doubt, mentioned by Lauverjat, it has been practiced twice at Nantes, by Bacqua,

and upon the same female; once by M. Le Maistre, of Aix; once at Martinique, by a Mr. Dariste; once in 1823, at Dahlen, by Vonderfuhr; again on the 18th of May, 1827, by the surgeons at the hospital at Florence; twice by Schenck; once again by Bulk; once by Græfe; once by Luch; once by Burns: again very recently in the colonies; so that it is now quite impossible to deny that some women, at least, may be saved through its intervention. Yet neither can the danger which attends it be denied. Boerhaave and Boer were certainly incorrect in the assertion, that scarce one instance of success occurs in fourteen cases, but it is quite certain that it has been performed four times in twenty years, at the Maternite in Paris, and that all four patients died; that out of seventy-three cases quoted by Baudelocque, death resulted in forty-two of them; that forty-five cases out of one hundred and six related by Sprengel, failed; and that of the two hundred and thirty-one cases mentioned by Kellie and Hull, one hundred and twenty-three did not succeed in preserving the lives of the women. Thus far it then may be said that one out of every two cases of Cesarian section has been fatal; and Tenon was certainly wrong in his statement, that since the days of Bauhin seventy women had been operated on at the Hotel Dieu, and recovered. According to Messrs. S. Cooper and J. Burns, although it has been done fifteen or twenty times, there is as yet no instance on record of a successful result of the operation in Great Britain.

Nevertheless, it does not, *a priori*, appear, how it should be of so terrifying a nature. The wounds which it is necessary to make through the parietes of the abdomen is very large, it is true; yet the parts cut through are by no means delicate; there are no arteries, no nerves of any size, no important parts to be avoided. The peritoneum is wounded; but the viscera are easily protected. How very common it is to see the most extensive and complicated wounds of the abdomen, and punctures of every kind occurring; and yet give rise to slight symptoms, and the patients to get well. Do we not every day divide the serous membrane of the belly unhesitatingly in patients affected with strangulated hernia? Is it the incision into the uterus alone which is so very dangerous then? On the contrary, there is every indication about the organs of feeble irritability; of very little inclination to take on inflammation; and the best condition of parts for safe and speedy cicatrization. Are there not cases on record, and particularly that recently published by Dr. Frank, of women who have submitted to and recovered from the Cesarian section, after laceration of the uterus. The wound at first is very extensive; but soon is reduced to four-sixths, or five-sixths of its length; and hemorrhage, when the organ is free to contract, ceases too soon to be even alarming. Is it not also possible, by means of proper precaution, to prevent any effusion of the liquor amnii, of blood, and other fluids into the peritoneum, during and directly after the operation. It would appear from this, that it is not alone owing to the operation itself, but to some particular condition of the patient operated on, that hysteriotomy is so fatal; and I cannot therefore help thinking, that if it were done as soon as it is positively indicated, and not after the woman is exhausted by vain efforts; after the uterus has become passive, or has taken on incipient inflammation, if not positively phlogosed; after peritonitis, or enteritis are imminent, or decided; after life is in short in serious jeopardy, the Cesarian section would not be so

frequently fatal, as unhappily it has so far proved to be. It is not only to be practiced on the living females, but is also proper to perform it on the bodies of such as die undelivered after the seventh month of pregnancy.

The Roman law, *lex regia*, which is attributed to Numa Pompilius, even then made it incumbent on physicians to open all women who died pregnant, as a means of preserving citizens for the state. The senate in Venice, to strengthen this ancient custom, passed a decree in 1608, and 1721, which subjected practitioners to very severe penalties if they did not operate on the supposed dead person with all the care which they would have exercised if she had been living. The king of Sicily enacted another law, by which he subjected to the punishment of death, such physicians as should omit to perform the Cesarian section on patients who had died in the latter months of pregnancy. As to the necessity of acting immediately after the death of the mother, with equal caution as during her life, it will be judged of by recollecting the difficulty of forming any certain opinion as to her actual decease, and the haste which is then to be exercised. Van Swieten and Baudelocque relate three cases of women believed to be dead, and who recovered from their lethargy, just as the operation was to have been performed upon them. Peu gives another instance, justly much more alarming. He was in the act of making his incision, when the woman started, ground her teeth, and moved her lips! Another equally remarkable, is mentioned by Rigaudaux. He was sent for two leagues from Douai, to see a poor patient, whose labor gave rise to the most lively anxiety. Ere he reached her she was supposed to have been dead two hours. Unwilling to cut into the abdomen without some further examination, he explored the sexual organs, perceived that the pelvis was an illformed one; passed up his hand to the feet of the child, and delivered it apparently lifeless; but which by care and attention was recusitated at the expiration of a couple of hours. As the limbs of the mother preserved their flexibility, Rigandaux forbid her interment before the abdomen became green. The woman happily recovered so perfectly in a few hours from her state of asphyxia, as herself to call on the surgeon four years afterwards, and inform him of her being still in existence.

When the Cesarian operation was performed after death, the incision was made always on the left side of the abdomen, "the woman," says Guy de Chauliac, "being opened with a razor on her left side, because of the liver, this side being so much more free than the right." But since it has been attempted on the living female, better principles govern its performance. Five methods of proceeding on the part of accoucheurs, among the many which there are, particularly require notice. 1st, That in which the incision is made along the median line, parallel to the axis of the body; 2d, that in which it is made outside of the rectus abdominis muscle; 3d, that in which the parietes of the abdomen are divided transversely on one side; 4th, that in which the wound is situated directly above, and in the direction of the Fallopian ligaments; 5th, that which is performed on a level with the crista of the ileum. Solayres, Henckel, Deleurye, and others, have erroneously given the credit of the first of these procedures, that of incising on the median line, to Platner, Guerin, or Varoquier. Mauriceau had previously expressed himself on the subject with great clearness. The majority are in favor of cutting into the left side of the abdomen; but, he continues, the opening would be

better made between the recti muscles, for there is nothing but muscles and integuments to be divided. This method—the one to which Baudelocque gives the preference, that generally pursued in France, Germany, and England—by being done on the linea alba, enables us to avoid the muscles, and to give but little pain: no artery can be wounded, and the uterus moreover is opened in a direction parallel to its principal fibres. It has also been urged against it that it incurs the risk of wounding the bladder; that the flow of fluids during or after the operation can be effected only with difficulty; that the wound, consisting only of fibrous tissues, is slow in healing; and that the uterus, by being opened in almost the whole extent of its anterior surface, tends by contracting rather to separate than approximate the lips of the incision into it.

In the lateral operation the older accoucheurs preferred generally the left side, and made their incision sometimes straight, sometimes slightly oblique; and at others of a crescentic shape, but always outside of the rectus muscle. This method, according to those practitioners who adopt it, has the advantage over the other of shielding the bladder wholly from any accident; of admitting of easy cicatrization; and of interfering less with the escape of fluids which ought to pass out by the wound. As the uterus is almost always bent a little on its axis by inclining to either the right or left side, it has been thought that the incision into the median line would fall rather on its left edge than on the middle of its anterior surface. Pursuant to this view it has been advised to operate on that side to which the uterus naturally inclined. Admitting the reality of these advantages, they would, I think, be more than overbalanced by the danger of cutting the epigastric artery, or its branches; of producing an opening whose lips could with difficulty be kept in contact, owing to the retraction of the oblique and transversalis muscles; and by the impossibility of obviating the defect in the parallelism with two incisions, that of the abdomen, and that of the womb.

To avoid the inconveniences connected with these two proceedings, *Lauverjat*, who at first had thought that hysterotomy in the median line offered great advantages, endeavored to methodize a plan which had by some physicians been before practised, and recommends that a transverse incision, five inches long, be made between the rectus muscle and the spinal column; more or less below the last false rib, according to the distance of the fundus uteri. Thus, says he, the fibres of the transversalis are separated rather than cut through; the lumbar and epigastric arteries are avoided; and the fundus uteri come down upon, whose cavity forms a funnel, so as to render the escape of the lochia both by the vagina and the wound very easy. Sutures are unnecessary, and the parallelism easily preferred. Simple position is sufficient to keep the edges of the division in exact contact. The outer angle of the wound having a depending direction, there is incomparably less fear of abdominal effusion than by any other method: but it may be objected that the fleshy fibres of the great and lesser oblique muscles are necessarily divided; that the least effort must expel the viscera; that the uterus is opened at its fundus where its vessels are largest, speedily retracts from the external aperture, and that the contraction of its fibres ought to hinder, rather than promote the healing of its cut edges; so that in fact, notwithstanding Lauverjat's two successful cases, and the seeming preference given to it by M. Sabatier and

M. Gardien, this method evidently is not less dangerous than the two which preceded it. Fearing above all things injury of the peritoneum and the body of the uterus, M. Ritgen has advised us, lately, to incise transversely the attachments of the broad muscles of the abdomen to the crista of the ileum; to detach the peritoneum as far as the upper straits, and divide the cervix uteri to an extent sufficient to admit of the extraction of the fœtus. In the first place, I do not see how it can be possible to divide the summit of the uterus, without also dividing the serous membrane which envelopes it; and the other inherent difficulties in the measure, added to the detachments which must take place in the fossa iliaca, seem to me such as cannot fail to render this equally dangerous with any operation previously spoken of. So far as my knowledge extends, however, it is a mere project; and as yet has never been practised by any one upon the living female.

The nephew of M. Baudelocque, who attributes the principal dangers which attend the Cesarian section to the double lesion inflicted on the peritoneum, and believing wounds of the uterus to be essentially fatal, has proposed a new method which, in this double respect, seems to him more advisable than any other; from which indeed it differs very considerably.

The incision begins near the spine of the pubis, extends laterally, parallel to Poupart's ligament, to a little below the antero-superior spine of the ileum. He selects the left side on account of the obliquity of the neck, when the uterus is inclined to the right; the right side in an opposite state of things. Having divided the wall of the abdomen, not injuring the epigastric artery, he pushes back the peritoneum from the fossa iliaca into the pelvic cavity, and from off the upper part of the vagina, which he then opens. This operation must be of some extent; and through it the finger is carried to the os uteri, which it endeavors to draw towards the wound in the abdomen, whilst pressure is made upon the fundus in an opposite direction to favor its reversion. When we have succeeded in bringing the cervix in opposition with the opening through the parietes of the abdomen, the delivery may be left to the natural efforts of the uterus, or if absolutely necessary the uterine orifice is dilated with the fingers, and the fœtus removed either by the hand or the forceps.

The conception of this operation, called "elytromia" by its inventor, is certainly highly ingenious. He has made on the dead subject, either pregnant or unimpregnated, many experiments, which have confirmed him in the favorable opinion he had formed of it; and which have been of sufficient influence to cause several practitioners to hesitate in their opinions as to its importance. Sir C. Bell and Mme. Boivin, fearing hemorrhage more particularly after the Cesarian operation, had equally felt the necessity of incising the womb as near its summit or neck as possible, in which spot the fewest vessels exist. I cannot bring myself to believe that in most cases such an operation is practicable; or that the laceration of the vagina, combined with the injury effected in the fossa iliaca and pubic excavation, can be much less dangerous than the simple straight forward incision through the peritoneum and uterus, which can be made in performing ordinary hysterotomy. I may add, that recently M. Baudelocque, junior, has himself been obliged to have recourse to the Cesarian operation, properly so called, in the case of a woman he had watched for a good while, after performing on her his "elytromia,"

and being assisted in the operation by M. Herves de Chegoin. I know the impropriety of drawing sweeping conclusions from a single fact; but the result of this, the only experiment made on a living female, with me adds great strength to the *a pirori* opposition offered by reflection to the views of the author. Another mode of operating, somewhat analogous to that of M. Ritgen, and not very far removed either from that of M. Baudelocque, seems to have been suggested about the same period by Dr. Physick. The surgeon, after observing that in many cases of pregnant women it was easy to separate the peritoneum from the bladder and from round about the neck of the uterus, thought that by making a horizontal incision directly above the pubis, the cervix uteri might be arrived at and opened without any interference with the serous abdominal membrane. The operation, whatever Dr. W. E. Horner may say of it, is rather unworthy of its inventor, and not worth discussing.

Method of Operation.—Never, and if particularly the operation recommended by Mauriceau be followed, should evacuation of bladder and rectum previous to its being commenced be neglected. The instruments, &c. required, are a straight and a convex bistoury, a probe-pointed bistoury, forceps, scissors, suture needles, ligatures, quills, strips of adhesive plaster, little balls, and square cakes of lint. Besides which, pieces of linen spread with cerate, long square compresses, a bandage to go round the body, large soft sponges, a syringe, gumelastic tubes in case injections are necessary, tepid and cold water, vinegar, wine, and eau de Cologne, are equally requisite.

The patient should lie as much as possible upon the bed to which she is intended to be confined for the first few days after the operation; and in as comfortable a posture as possible. She is to be placed upon her back, her head gently raised, the legs and thighs very slightly flexed; assistants are directed to watch over her motions, lest she should make any inconsiderately under the influence of pain. Two experienced persons are to apply their hands upon the sides and fundus of the uterus, so that no other part may slip between its anterior surface and the parietes of the abdomen, and so that it may make as it were but one substance with this latter part. I think it is better to apply the bare hands themselves than to place them on large sponges, as is advised by Drs. Hedenus and Kluge.

The surgeon with the convex bistoury, cuts through the integuments from about the umbilicus to the pubis, a distance of five or six inches, it not being necessary, or always possible to make for this purpose the large fold advised by Levret.

Next he divides in the same manner the subcutaneous tissue, the muscular aponeurosis and fibres, unless the incision is over the median line; and also the cellular tissue. This incision must not be carried too low down towards the symphysis on account of the nearness of the bladder, and because the abdominal parietes just here, are usually very thick. It would be better to extend it above the umbilicus, being careful to pass to the left of this cicatrix to avoid the umbilical vein, and particularly the anastomosis which may possibly exist between it and the epigastric vein, which distribution has of late years been noticed by MM. Mesniere, Clement, and Martin.

Having laid open the peritoneum to an extent sufficient to admit the introduction of the left index finger, on which the instrument is to be conducted, the wound in the membrane is to be enlarged with a probe-pointed bistoury until it acquires the same length as the incision in the skin. The uterus is then laid bare. It is cut through slowly, layer by layer, until we come down to the surface of the ovum. The assistants are then desired gently to press down the fundus uteri, by giving it a see-saw motion forward, with a view to preserve as much length of neck as possible; or we might follow the advice of M. Kluge, and hook the finger in the lower angle of the wound in this organ, to produce, or at any rate favor, a like movement, which in giving an opportunity to prolong very considerably the section upwards, allows the cervix to be spared. To avoid wounding the vessels of the placenta, it is better to finish the incision with a probe-pointed bistoury, than to use the convex bistoury upon a director. I know of no objection to detaching the placental mass and its membranes beforehand to some extent with the finger.

Now it is, and not before the operation, that we may perhaps be allowed to follow the advice of Planchon, to rupture the membranes high up in the vagina with the fingers, or as is customary in Germany with Siebold's instrument. If, which I think is peferable, the membranes inclosing the ovum are punctured from the wound, it then becomes necessary for the assistants to be doubly careful not to permit the abdominal parietes to leave the matrix. Thus we shall guard against effusion of the waters into the peritoneal cavity, and do away the tendencies which the intestines have to escape outwardly.

Removal of the fœtus is to be effected without delay. When it presents by the feet, head, or breech, it is removed in that position; and to aid its exit, the assistants are desired to press slightly on the sides of the matrix through the parietes of the abdomen.

If it be in any other position, the feet must be taken hold of, and the extraction made with as much precaution as in a natural delivery, being above all particularly careful not to confound or injure by violence the lips of the incision into the uterus.

After the delivery of the fœtus, we may follow Planchon by the assistance of a gumelastic catheter, bring out the funis through the uterus so as to deliver the after-birth by the vagina; although no future advantage is gained, and the operation is materially lengthened by so doing. Besides which the contraction of the uterus, which most often renders it impossible, soon obliges the placenta to engage in the wound, indicating thereby the preferable mode for its extraction, that it may offer less bulk and resistance. It is even better to take hold of it by the edge when we can do so, than to pull merely on the cord. Care is to be taken as in a natural delivery to twist the membranes into a rope, to prevent any from remaining behind in the uterus. If it contain clots of effused blood they must be taken out with the hand. It is also admissible to wash out the parts with an injection of warm water; although I do not think that with a view of keeping open the os uteri, the plug of lint which Baudelocque recommends, the hollow bougie of Ruleau, the tent of Rousset, the catheter of Tarbe, or any other species of tube whatsoever, are necessary. They do not prevent closure of the orifice, and would only increase the irritation without any counterbalancing good. The intro-

duction of the finger from time to time will serve to open it again if it cease to transmit fluids, which nothing can prevent from passing wholly or in part through the wound after all.

The operation being over, the flow of blood is next to be attended to and arrested. In the lateral procedure, especially in that of Lauverjat, many small arterial branches may have been divided. These are now to be tied, unless it has been thought better to do so during the progress of the operation as they were successively opened. Whilst the operation is going on the orifice of the uterine artifices are to be stopped by the fingers of the assistants. There can be no need of tying them, but it has been advised to cauterize them in the plugs of vitriol, or more often, to trust the uterine contractions, which if slow in occurring, are to be solicited by stimulating the cavity of the organ or the wound with the fingers, or with pieces of linen dipped in vinegar and water.

At the end of a few minutes, the incision is reduced to an extent of only one or two inches, after which every kind of hemorrhage becomes impossible. It is usual in England, Germany, and even in France, to unite the wound in the abdomen by the interrupted or twisted suture, because it is said it is the only means of keeping the surfaces in contact, and guarding against ventral hernia. Still we are recommended to do without it by Sabatier, who says, that unless the sutures were to go through both thicknesses of the abdominal parietes, which would be dangerous, straps of adhesive plaster do quite as well as stitches, and do not, like them, involve the safety of the patient. I think it preferable, notwithstanding the reasons assigned by this learned writer, to employ stitches, even when we have pursued the plan of Lauverjat. In every case the lower angle of the wound is to be left free, to allow of the escape of the fluids, and to permit the pledget or tent which has been left in the uterus to conduct them outwardly. The insertion of stitches moreover does not prevent the application of adhesive strips between them; nor do they interfere with the use of a bandage and favorable position to facilitate the action of the plasters. The wound is then to be covered with a linen rag perforated with holes, or with strips spread with cerate. Two large long compresses are placed on the sides, little cushions of soft lint, common compresses, and a bandage well put on around the body, conclude the dressings. We are before leaving the woman to take from her person the linen which has been soiled during the operation; then to carry her as gently as possible into the middle of her bed, where we try to dispose her so as that every muscle shall be in a state of relaxation.

An anti-spasmodic draught, containing a gentle opiate to overcome nervous agitation; proper precautions for insuring the lochial discharge by the vagina, and guarding against its effusion into the abdomen; demulcent drinks; venesection, and leeches, if the least inflammatory symptom shows itself: together with recommending the utmost calmness and tranquillity both of body and mind, comprise all that can be done by the surgeon for his patient to save her from the dangers by which she is menaced.

Art. 14.—*Vaginal Uterotomy.*

According to authors, very many causes may require the performance of

this—the vaginal Cesarian operation. Such as are most frequent, are obliteration, and fibro-cartilaginous induration of the cervix, as in the case of which Simson speaks, and in that also related by Van Swieten; violent convulsions, which threaten the life of the patient, whilst the orifice is too tense and too imperfectly dilated, to allow of the introduction of the hand into it, as is seen by the cases of Duboscq and Lambron; extreme backward obliquity of the orifice, the head of the child all the while dragging the anterior wall of the uterus before it as far as the vulva, distending and thinning to a degree which must end in rupture, unless we hasten, as Lauverjat did, to make an incision into it. It may be useful also, when the uterus, which had prolapsed from the pelvis during pregnancy, has never been reduced, and that its neck cannot be dilated by the fingers, although there be danger in protracting the delivery, of which circumstantial examples are furnished by M. Thenance, Jacomet, and a surgeon at Vaux, quoted by M. Bodin. It is, however, in cases of scirrhosity, that it has more especially been proposed, in which, so great is the resistance offered by the part, that the woman exhausts herself in vain efforts to accomplish its dilation. Lastly, it would be equally proper to resort to it, as M. Bodin has endeavored to prove, in case of an arm presenting, and it was ever really impossible to grope for the feet, and no other means left of avoiding amputation of the member.

The speculum employed by some is unnecessary. With a probe-pointed bistoury wound round with a strip of linen to about ten or twelve lines of its point, carried upon the fore finger, the neck is easily reached, unless it be very far from the axis of the pelvis. If this on the contrary be the case, the probe-pointed one should be laid aside, and Pott's curved bistoury substituted for it. One incision in strictness would suffice; but as it is important that it should not be too deep, it is better to make several at short distances from one another. It might at first seem as if the head could not effect a passage without enlarging such wounds considerably, almost to carry them into the body of the uterus, and lacerate the peritoneum. However, no such thing happens, and they remain most commonly limited in extent with the thickness of the neck. When they are practised for scirrhous or fibrous induration, scarcely more than an ounce of blood escapes from the part. It is in this case that M. Duges, I think justly, recommends the removal of the diseased parts instead of a mere incision into them. When the anterior surface of the uterus is divided, without one incision extending quite as far as the mouth, a straight or convex bistoury, not buttoned at the point, must be employed for commencing the operation, which is much more delicate in this than the preceding cases. Too much care cannot be taken to avoid wounding the presenting part of the child in making the incision. When, however, the uterus is opened into, the finger becomes a sure director, and on it the instrument may enlarge the incision as far as it is found necessary without any danger. Let me remark, that less risk is incurred in carrying it backwards than forwards, on account of the situation of the bladder, and that moreover it is needless to give it too great an extent.

The wound after delivery rapidly contracts, and often before twelve hours has elapsed, the cervix resumes its natural position. Should the flow of blood be too abundant, injections of oxycrate, and the use of a tampon, will generally arrest it without difficulty; and cauterization, which by the way is easily

tried, will in such cases be rarely indispensable. As to the lochia, they escape either through the os uteri or by the wound; and as concerns them, the woman requires no other attention than that usual after ordinary labor.

All details relative to cephalotomy, the use of crotchets, fillets, forceps, the operation of turning, &c., being fully entered into in the 2d volume of my Treatise on Tokology, I do not propose to reinsert them here, particularly as these are operations which it is exclusively the province of the accoucheur to perform. I have spoken of symphyseotomy, and the Cesarian section, only because a surgeon is sometimes called on by those who have wholly devoted themselves to the study of obstetrics to perform them.

CHAPTER V.

THE URINARY APPARATUS.

SECTION I.

The Operation of cutting for Stone or Lithotomy.

A. *In the Male.*

The operation for stone which is one of the most ancient in surgery, is also one of the most important and severe. None, perhaps, has given rise to more treatises, to more discussions, to more labor of every description. The object which it has in view is, the extraction of whatever substances may have become lodged or formed in the bladder by an artificial passage or aperture.

Although the word "taille" (cutting) is a very insignificant one, and not very scientific either, I shall employ it in preference, nevertheless. The term "lithotomy" is, in this case, of vicious acceptation; that of "cystotomy," is no better, since the urethra, and not the bladder is most commonly divided. The fact, that every one knows what is meant by "la taille," is another very good reason for its use.

Hippocrates, who does not describe it, nevertheless alludes to it at some length, and proves that there were in past ages, as there are in the present, surgeons' errant, whose whole occupation was to perform it.

To the father of medicine it appeared either so dangerous or so unworthy, that he required from his pupils an oath that they would never perform it; an oath which, if history may be trusted, was not a useless one; since some of the lithotomists of the day, bribed by Tryphorus, the usurper, were immoral enough to perform it on the young Antiochus VI, who had no stone, in such a way as that he died under their hands.

Celsus, the first who has truly described it, endeavors to prove that it was applicable only to persons at least fifteen years of age. This, it appears, was the doctrine of the Alexandrians, from whom the materials for his chapter seem to have been collected; and this view was also taken of it by most authors until the time of Marianus Santus. Since then both sexes have been subjected to it, and at all ages. Still, with all the numerous improvements which have been in the method of doing it, and in all that concerns it, it has

always been looked on as so dangerous, that some measure is ever being suggested to render it unnecessary. None of them having answered; and all belonging properly to the head of true pathology, we shall not here engage in their examination.

Neither shall I say any thing in refutation of the strange idea of Dr. Dudon, who recommends plunging an immense trochar into the bladder through the hypogastrium, as a means of getting at the stone, inclosing it in a little bag, and dissolving it in appropriate chemical reagents before its extraction.

To feel all the danger and all the absurdity of such a measure, it requires only to allude to it. I should not even have done that much, however, if the inventor had not, to my knowledge, been daring enough to put it in practice on a living being; and if the man who was himself brave enough to submit to a second equally fruitless attempt, had not very near fallen a victim to his credulity. Other practitioners have contrived to break and pound the stone in the bladder into smaller portions, and in this way to withdraw them from it by the natural passage.

These trials are now made regular methods under different names, and will be considered hereafter in a separate article.

Diagnosis.—Most persons who labor under stone, experience from time to time, if not constantly, a dull pain and a sense of weight about the fundament; the pain increases on motion on the receipt of jars, as when the patients ride on horseback or in a carriage, or when they are compelled to undergo the least jolting.

The urine deposits a whitish sediment or flaky mucus, sometimes viscid and ropy. The deposits are likewise sandy and turbid, seeming to be purulent, fetid, and tinged with blood. During its emission it often happens that the flow is suddenly suspended; and a very simple change in the position of the body will allow it again freely to gush forth, as if some valve for a moment had been placed over the orifice of the urethra. The pain felt in the neck, sensibly increases as the bladder becomes empty, and particularly immediately after it is completely so. The extremity of the penis is the seat of a pruritus, which leads the patient to be constantly rubbing and pulling at it; and which is the reason why great length either of the penis or prepuce is in children a strong symptom of calculous disease in the bladder. The patient has a frequent desire to urinate; and some pass from time to time gravel, or sometimes considerable portions of stone. However, it is not common to see all these symptoms combined in any one individual; many have scarcely any one of them. Again, many diseases of the urinary passages present frequently the reunion of them all. Catarrhus vesicæ, for example, may be attended with all the changes which occur in the urine in cases of calculus. If with it there exists any irritation in or alteration of the urethral funnel, the pain, the frequent desire to micturate, and friction of the penis, may exist as if a stone were present. The feeling of weight about the anus equally exists in enlarged prostate. Hundreds of people have sandy deposits and gravel, who yet have not stone. Of all the symptoms, that which seems to be the most conclusive, the sudden stoppage of urine as it flows when the bladder is not yet empty, is likewise met with under other circumstances. The prostate gland may produce a fold behind the urethra, capable of creating a mistaken notion on this point. The same thing would be caused by a fungous tumor, or cerebroid mass springing from the bas-fond of the bladder, one of which occurred

last year at the Hotel Dieu. It would occur with still greater facility even, if the inferior wall of the urethra were to give rise to any polypous or pedunculated mass, one of which was met with by Mr. Samuel Cooper, which should extend into the neck of the bladder.

A patient who died at the hospital St. Antoine whilst I was in attendance there in 1829, presented this peculiar disposition. It had frequently happened that his urine stopped before the bladder had been emptied. Sounding failing to convince me of the existence of a stone, I did not think of cutting the man. The uvula vesicæ gave origin to a tumor like the fibrous masses of the uterus in density and structure. The tumor, whose footstalk was very delicate and much flattened in the course of the urethra, was as large as a small hen's egg, and when pushed a little forward, closed the urethra with great exactness like a cork. The proof, moreover, that no one of these signs is conclusive, is that experienced surgeons have often cut patients in whom no stone was found; and they alone, therefore, can never justify the operation.

Catheterism.—Sounds and bougies not metallic do not answer for the examination of calculi. Instruments of silver, copper, gold, or platina, are employed for this purpose. The three latter however which have the merit of being more sonorous, are rarely made use of; the silver instrument being generally preferred. Some have also thought that a solid sound, or ordinary staff, should be substituted for the hollow instrument, because as being more firm and weighty these stems of metal would allow the calculus to be more distinctly felt. There are unimportant minutia which a really clever surgeon should neglect. When the instrument is in the bladder its stylet must be withdrawn, lest it might mislead our senses by some unexpected friction against the sheath which contains it. The thumb which is applied over its orifice, whilst the index and medius fingers hold it behind its rings, must completely cover it, for if it were permitted to vacillate, the result might be a vulvular movement producing a noise equally capable of deceiving us. By following M. Boyer's advice, and plugging it with a cork, &c., this no longer would be to be feared. We must be careful to introduce the sound when the bladder is full of urine; as in that way we contrive to explore the whole organ most surely. If the patient lies down, we begin by moving the point backwards upon the median line to the right and to the left, inclining it with greater or less force to either side. Then we raise the beak up as high as possible towards the top of the bladder, powerfully depressing the open extremity; after which it is proper to pass the heel (curve) of the instrument over the neck and parts adjacent, and upon various points in the bas-fond. If all this is done, and no stone met with, the patient is made to sit down on the edge of his bed; or he may be requested to rise and walk a few steps, and it is also sometimes of use to let him lie first on one side and then on the other. As a last measure, the surgeon gives exit to the urine, and without disturbing the instrument waits until the bladder contracts upon itself, so as to push the calculus towards the urethra, and in contact with the metallic sound.

In a majority of cases these varied researches will speedily assure us with certainty that a stone exists; but only because we do not discover one it is not certain that a stone is not present. Very small stones sometimes escape the

manipulations of the most skillful. There are often cavities of such a depth as that the sound passing above them gives no sensation of encountering a solid body. It is not very uncommon to meet an excavation directly behind the prostate, either on the right or left side, or in the whole extent of the bas-fond of the organ in which stones of a certain size easily escape the notice of the searcher, as the fact which is related by M. Belmas proves. In other cases the stone is, as it were, pinched between two folds of the urinary bladder; it may also be fixed in some particular cul-de-sac, whether the mucous project as a hernia between a separation of the fibres of the bladder, as often happens in what are called "vessies a colonnes" (bladders in which there are fibres resembling the columnæ carneæ of the heart), or whether a true cyst have formed around the stone as M. Meckel says he has observed. It is clear that if the foreign body is not quite unconfined at any part of its surface, sounding will not indicate its presence; and that in the other cases it is only by the changes made in the position of the patient and the motions of the sound that we can hope to discover it. It has been thought that when the difficulty arose from the small size of the stone, or that the friction of the instrument was too feeble to be accurately perceived, auscultation might be of some assistance. M. Lisfranc was one of the first who proposed this plan; the ear or the stethoscope is applied to different spots on the hypogastric region with the usual care, while the instrument is manipulated in the bladder at the same time. This is done with the hope that no sound will escape attention, and that the slightest echo of the sound as it touches the stone will be detected by the ear. To render this resort yet more delicate, a young American surgeon, Dr. Ashmead, recollecting that air conducts sound better than liquids do, conceived the idea of filling the bladder with this fluid. It is not worth while to deceive oneself about the value of such improvements as these.

Every time that a sound fairly touches a calculus the surgeon will feel it as well by his hand as by his ear. I could never advise any one to assert upon the evidence of auscultation that there existed in the bladder a stone, the presence of which simple sounding did not otherwise convince him. To return; the only difficult thing is not to feel or to hear the stone, but to touch it—to strike it on its bare surface. If in a great many cases the catheter detects no stone, although there are realiy several, cases again occur in which it is possible to commit the opposite error. Exostoses behind the pubis—several of which have been met with by Houstet, Garengeot, Jules Cloquet, Belmas, and Brodi particularly, who encountered one weighing twenty ounces—and other osseous tumors which grow from the ischion as is related by M. Damourette, from the sacrum or os coccygis as in the plate given us by M. Haber in his thesis; an osseous cyst in the thickness of the parietes of the bladder of which M. Boyer's book offers an example; all these things have led surgeons into error on this subject. The projection of the sacro-vertebral promontory does the same thing. But it is in the texture of the bladder itself that the commoner causes of error are to be found. I have frequently perceived that in slipping the point of the sound from the median line to one side there occurs a jerking motion, whence results a feeling of resistance or of inequality, very liable indeed to deceive those who are not aware of this peculiarity. This is owing to the cavity of the bladder being frequently

rugous, as is were knobbed; and to the fibres of its muscular membrane being almost always gathered into bundles more or less distinct.

Also, it may depend on the presence of masses of a fibrinous, or of any other character, either free or adherent, which may have been developed upon its inner surface. If there be any doubt, the operator must not neglect to introduce one or two fingers of the left hand into the rectum, to lift up the bas-fond of the bladder, and favor its contact with the instrument as well as other proceedings usual in sounding. Moreover, we know, that more than once, the fingers thus situated, aided by pressure with the other hand on the hypogastrium, have alone been successful in establishing the presence of stone without the assistance of the sound. These details might appear superfluous were it not to be recollected that it is proved by innumerable observations, that immense stones may remain in the bladder for many years unperceived by the patient; and that the operation of lithotomy has notwithstanding skillful researches, been practised in other cases upon individuals who had no stone. Every one knows the history of the monk who bequeathed his body to the surgeons; so certain was he of having a stone, which none of them could discover. Lapeyronnie, D'Alembert, the "*tailleur*,"* named Portalier, the watchmaker spoken of by MM. Deschamps, Sabatier, and Richerand, had each of them an enormous stone in the bladder, of which they gave no evidence nor had any symptom. Another case is mentioned by M. Texier of this kind, which M. Marjolin in his lectures used to relate; it was necessary to saw through the pubis to extract it. In Desault's Journal, on the other hand, we may read the admission of Leblanc, that he had cut a person in whom there was no stone. Desault himself seems to have committed a similar error. Mr. Samuel Cooper asserts that he knows of seven instances which happened to as many different surgeons. I can, for my own part, affirm to four. The first was in one of the provinces; it was done by a well informed surgeon, and the patient did perfectly well: the second was done at a Parisian hospital upon a child who died: the third occurred also in an establishment in the capital: the fourth concerns a young colleague who still lives. Now, as all these mistakes have been committed by men whose knowledge and skill cannot be doubted, we may safely be permitted to hesitate before we engage in a like undertaking. Warned by these dangerous errors, the prudent surgeon will never decide upon the operation for stone, unless he has carefully detected the calculus by the sound, not once only, but twice, thrice, or even more times, if the least doubt exists in his mind after the first examination. To be more certain still, he should take the precaution to let others perceive for themselves, what he believes himself to have felt.

On this point, I cannot help mentioning a fact which observation has established, and one of the most curious of all, viz. that those symptoms which most often simulate those of calculus, which in Roux's opinion depend on some specific irritation of the neck of the bladder, disappear in general soon after the performance of the operation. Another remarkable thing is, that these persons recover in much larger proportion than do those who have really calculus in the bladder; notwithstanding that the numerous manipulations which then become almost necessary, might lead us to infer that the contrary would be the case.

* This word may mean lithotomist or tailor.

Catheterism, in fact, can indicate to a certain point the state and condition of the calculi whose existence it detects; their bulk, density, position, fixedness, or mobility. When a stone is felt now at one point, and now at another, when it glides away on the slightest touch, andwhen after having touched it, it is difficult to meet with it again, two things are evident; 1st, that it is entirely unadherent, and 2d, that its bulk is inconsiderable.

If, on the contrary, it is felt at the neck of the bladder, and the instrument strikes it in whatever direction it is moved, it follows that it is very large; unless perhaps it may be fastened on the vesical trigonal space, or at the commencement of the urethra.

The size of a calculus being a very important subject of inquiry, it has been attempted in all ages to acquire some method of ascertaining it. The catheter once in the bladder, can, in the hands of a person very much accustomed to its use, give very accurate information upon this particular. To obtain this the patient must not move, while the surgeon is to remark attentively the first contact of the two bodies; then to carry the beak of the sound from before backwards over the entire surface of the stone, or else to attempt to hook it in the concavity of the instrument, as if to draw it towards the urethra. This manœuvre, when performed in an empty bladder, often succeeds in giving us a very near approach to the dimensions of the stone.

Surgery has, besides, other means than these of arriving at this result. One of the best, I think, will be found to be the sound which I have had constructed, and of which we shall speak farther on. This instrument is so arranged, that when introduced, the two halves which compose it, sliding one over the other, much like the foot measure used by shoemakers, render its beak an instrument capable of seizing the stone in its grasp, and of determining its size. The forceps for lithotrity would answer much more surely for this purpose, but they are inconvenient from being straight and more difficult to use. We are not, however, to expect that with these instruments we shall always be able to ascertain exactly the size of a calculus. This could only happen if it were invariably perfectly round, or that we could be sure of having seized it in the proper position. Now there are flat ones, oval ones, and stones of all shapes imaginable. The forceps may have hold of them by one angle, or at one end. They, in turn, may have got too near the roots of the instrument, or may be held only by their extremities.

A stone may be considered as friable, and of no great cohesiveness, when the sound emitted on striking it is dull, or that notwithstanding the calculus appears to be of considerable size it is very feeble. If the collision, on the other hand, is attended with a clear sound, and the calculus is not displaced without a certain degree of difficulty, its density must be considerable. When it is met with always upon the same side, follows the changes in the position of the patient, and when after having touched it at one point, the instrument may be carried all round in the bladder without meeting with another, it is probably single. If, on the contrary, the sound strikes on a calculus to the right and to the left; and if, after having laid the patient on one side, it no longer meets with any thing in the upper-most part of the bladder; if during the operation of sounding another collision is heard different from that made with the first stone; if the staff successively displaces several mobile bodies, we may naturally conclude that more than one calculus exists in the bladder.

Still nothing is easier than to err on the subject, and the most accurate researches give at best only probable results, except in some few exceptions, in which the proof amounts almost to certainty.

It is not easy either to decide on the fixedness or adhesions of vesical calculi. A stone appears to be immovable sometimes because it fills nearly the whole of the bladder; at others this appearance is owing to the contraction of the organ; and again, sometimes because of the size of the stone itself: and also because it is situated in a cavity of greater or less depth, though it may perhaps be met with soon after in some other place. It may cling by one extremity to the ureter. This position, which many writers have noticed, is remarkable in that the stone, though it may be several inches in length, may project a very little way into the bladder. We may suspect such a case, when the catheter encounters a sort of point, which nothing can displace, near the neck and a little outwards towards the base of the trigonal space. We cannot probably, however, thus distinguish those which are enclosed in pouches, or abnormal sacs, from those which have really contracted adhesions with some part of the mucous lining. Of this, as with other diagnostic essays, the same may be said; sounding, well performed, will always excite stronger or less powerful presumption, but never can be attended with absolute certainty. Nevertheless, if a stone incarcerated by one of its ends in the prostatic portion of the urethra, project by the other into the anterior of the bladder, of which MM. Le Dran and Blanding each mention an instance, its situation might be known by carrying a finger up into the rectum, whilst the sound was kept on the head of the stone. To these particulars we shall return when speaking of the last stage of lithotomy.

Indications.—Cutting is the only remedy applicable to individuals affected with urinary calculus, unless lithotrity can be performed in their case. Some few, it is true, get well without this operation; others suffer so little from the disease, that to cut them would be worse than imprudent; yet the spontaneous disappearance of calculi is so rare, that it should never be calculated on. It is not uncommon to see them escape through the urethra, unless they are not larger than a grape seed or of a small kidney bean, in which case it is sometimes seen. Others, which have made their way by ulceration through the perineum or the rectum, and thus perforating the tissues, are merely exceptions, in themselves almost as dangerous as is the operation itself. The calculus acting only as being a foreign body, may, when it is enclosed in the parietes of the bladder, or in small adventitious sacs, cause but very little suffering to the patient; and its existence may, under such circumstances, be compatible not only with life, but with the enjoyment of perfect health.

The facts related by Deschamps and several others, prove also that immense unattached calculi may exist in the bladder, and yet permit those who have them to run long careers, and be perfectly well notwithstanding. For all this, none of these uncommon circumstances in any way weaken the general rule, and as soon as the presence of stone is conclusively established the idea of the operation immediately presents itself to the mind.

The size, form, or situation, nor the nature of the stone scarcely ever constitute obstacles to its performance; and the circumstances which contraindicates it, are much the same as those of any other great operation. It is well to state, that catarrhus vesicæ, swelling of the prostate, and most

changes in the structure of the bladder, are frequently the results of the presence of the stone, and that it is common to see them disappear upon its extraction.

Lastly, a remark which has been already made by a great many authors, and one which cannot be too often repeated is, that those persons who have suffered severely from their stone, do, *cæteris paribus*, much better after the operation than those who have scarcely perceived it, or who have only recently felt the symptoms.

Formerly lithotomy was practised only during the spring of the year. At this season all the patients with calculi were collected into the hospitals, and they gathered also in the towns, to which the wandering lithotomists flocked to operate upon them.

This is now no longer the case. Cutting for stone like every other operation in surgery, is done at every period of the year; only, as stone is a slow disease, and that in most cases there is no danger in protracting the operation for some months, as likewise very hot, or very cold seasons seem rather less favorable than others to its success, it is still customary to prefer the spring and fall, when no reason exists for hastening events.

An indispensable precaution to be taken before cutting a patient, is to see that his urethra is perfectly free. It is a fortunate occurrence, that we are obliged to do this in spite of ourselves; for to detect the stone we must pass through the canal. If it be strictured sounding cannot be practised. Care therefore must be taken to treat this disease by proper means, before lithotomy is had recourse to. The other preparations consist of venesection or of leeches to the anus; of a low regimen for some days, and a slight purgative to relax the intestines, and guard against sanguinous congestion.

I need not say that if there exist other accessory lesions besides the principal affected, they must be combated and wholly removed, before any thing else is done. Lastly, it should never be neglected to administer on the preceding evening, or on the morning of the day fixed for the operation, an injection, so as completely to empty the organ of defecation.

The operation decided on, a great question arises as to the particular manner in which the stone shall be extracted. There are three principal ones, viz., one which consists in opening the bladder through the perineum; one which does it through the rectum, or vagina; and thirdly, one which attains the end by going through the hypogastric region into the urinal reservoir.

Art. 1.—*Of the cutting through the Perineum* (*by the lower apparatus*).

The method of cutting for the stone through the perineum is the most ancient of them all. The parts which it is necessary to pass through in performing it, require such exact knowledge of their position and relations, that it is indispensable for me to point them out acurately before I proceed to any further details about it.

§ 1. *Anatomical Remarks.*

The pelvis ends, as is well known, by an aperture known by the appellation of lower strait; the form of which is oval, or that of a heart, of which the

larger end is turned backwards. In treating of lithotomy, it is unnecessary any farther to consider the diameters of this strait, as is done when speaking of delivery of women. That which extends from one tuber ischii to the other, is in general not more than about three inches in the male, which length tapers off insensibly forwards, and is only eight or twelve lines, or less even near the symphysis of the pubis. It diminishes in length equally as we near the coccyx, but in a much less proportion than in the preceding direction. Its dimensions may be lessened by numerous anomalies and pathological alterations, to a degree which may present an obstacle to the extraction of the calculus.

Besides the facts of which I spoke as calculated to impose upon a surgeon for stone, he should also remember that Bonetus saw it so contracted as scarce to admit the finger; that in a patient mentioned by Delannay it was almost entirely closed by the head of the femur; that the same thing was effected by an exostosis mentioned by M. Thierry; by an ossification of the falciform edge of the sacro-sciatic ligaments described by M. Belmas; and that Noel of Rheims was also arrested by a similar difficulty in a pelvis which was shown me by M. Loze. The soft parts which fill up the whole, are numerous and important. The transverse diameter divides them into two parts; the anterior comprising the perineum properly so called, the posterior forming the anal region. To this, we shall return in our description of the recto-vesical operation.

The perineal region, which is represented by a triangle, the base of which rests upon the fore part of the anus, is divided into two equal parts by the median line or raphe of the perineum, and its free upper part surmounted by the scrotum and genital organs.

1. Its *Integuments*, which are soft and wrinckled, enjoy extreme mobility; which renders it necessary to stretch and make them tense when we are going to divide them. The subcutaneous cellular tissue here is of equal laxity. As we penetrate deeper it becomes more and more filamentous, and more loaded with fatty cells; and even forms on either side, in the cavity which separates the bulbo-cavernosus (*acceleratores urinæ*) muscles from the ischio-pubic ramus, a flocculent mass, sometimes of considerable thickness, and which often becomes the thicker still as it extends backwards between the ischium and the end of the rectum.

2. The *aponeuroses* deserve so much the more attention from me, as that notwithstanding the numerous researches made into them the descriptions given of them are as yet very obscure. Nevertheless, in the perineal triangle they may be easily understood. There are observable two laminæ; the one, the superficial or inferior, which covers the free surface of the bulbo and ischio cavernosus muscles (*erectores penis*) like a thin veil, goes posteriorly to blend with or lose itself in the other, and thus it remains distinct from the fascia superficialis, of which many from inadvertence doubtless have considered it to be an appendage. The second of these two laminæ, starting from the sub-pubic ligament passes back as a septum adhering to the inner lip of the ramus of the pubis and ischium, and is continuous with the edges of the sacro-sciatic ligaments. This layer, which has been called by Colles the triangular ligament of the urethra, and by others the median aponeurosis, is perforated at its posterior part by the membranous portion of the urethra.

At this point it forms a pretty solid barrier betwixt the prostate and bulb of the urethra, and continues itself with the superior pelvic aponeurosis after having supplied a fibrous expansion to the gland I have just named the prostate. This horizontal direction it does not retain in its whole extent. When it reaches the anal region it bounds or circumscribes an excavation more than an inch in depth, into which, when a certain method of operation for the stone which may be called the ischio-rectal is performed, the instrument is obliged to penetrate. This excavation, which is bounded without by an aponeurotic layer continuous with the sacro-sciatic ligaments inferiorly, and by the inner lamina of the fascia-pelvica superiorly, contains within it a much thinner fibrous lamella, and the exterior surface of the extremity of the rectum extending backwards on the deep surface of the great gluteus muscle, it forms anteriorly a slight cul-de-sac above the transversus-perinei muscle, which is more or less entirely filled up by the cellulo-adipose mass I mentioned a short distance back.

3. *The bulbo-cavernosus muscles*, which extend from the point of the sphincter-ani upon the lower surface and sides of the bulb of the urethra, as well as the ischio-cavernosus muscles, which embrace each root of the corpus spongiosum of the penis, have here no real importance; unless it be through the medium of the aponeurosis which separated them from the cellular layer, and of the triangle of which they are the boundaries; a triangle whose base dips down into the ischio-rectal excavation, and which like this excavation is filled up with filamentous, cellular, or adipose tissue.

The transverse perinei, extending from the ascending ramus of the ischium in front of the anus, intercrosses with that of the opposite side; and blending itself at the same time with the origin of the bulbo-cavernosus and some fibres of the sphincter-ani externus, it forms below the membranous portion of the urethra a decussation, a fibro-muscular mass, which is cut through in almost every operation for stone.

4. *The Arteries of the Perineum* spring principally from the pudica interna. The first we have to examine is the *inferior hemorrhoidal.*

This vessel comes off from the primary trunk, and crosses the aponeurosis very far backwards, so that as it goes almost entirely to the environs of the anus, its wounds are but little to be feared in the extraction of calculi. The second is the *superficialis perinei.* It arises a little before the tuberosity of the ischium, and behind the transverse perinei muscle; quits the aponeurosis directly, dips down to pass below its horizontal portion, and passes forward as far as into the septum of the dartos, ploughing up the cellular tissue, and following the ischio bulbus-triangle. In its course, the superficialis artery is sometimes nearer to, sometimes further from the median line or the integuments. Its size, which is sometimes larger, and its varying position, are causes why it is often wounded, and why the hemorrhage it affords is in some patients serious.

The third, or *transversa perinei*, points from the pudic artery, in the thickness of the triangular ligament or horizontal aponeurosis; tending gradually downwards and inwards, crosses the muscle of that name, and soon divides into three branches, one of which goes to the fore part of the anus, the second to the tissues below the membranous portion of the urethra, the third to the bulb of the urethra itself. Though usually not so large as the artery preced-

ing, this vessel is far from always occupying the same place. It is found sometimes three, four, and even five lines more in advance, and then is distributed almost entirely to the bulbous and spongy portions of the urethra.

At other times it follows the posterior edge of the transverse muscle so exactly, that at its union with the one on the opposite side it seems a mere arch in front of the anus.

The Pudic Artery, the starting point for all the others, follows a less variable course. It is to be found supported, as it were, by the pelvic surface of the outer aponeurotic layer of the ischio-rectal excavation, and of the falciform fold which ends the sacro-sciatic ligament in the properly so called perineal region, that is to say, in the pubic arch. It lies betwixt the laminæ of the horizontal or triangular aponeurosis, and so proceeds until it gets above the root of the penis, where it is lengthened out and takes the name of arteria dorsalis penis. Thus it will be seen, that in its whole course it is powerfully protected; first by the aponeurosis of this region, and again by the ramus of the ischium and pubis itself, as well as by the edge of the tuber ischii behind. From its position it can only be got at after all the fibrous laminæ of which we have spoken above are cut through, to do which we must proceed downwards to a great depth.

Some abnormal arteries have also been met with in the perineal region. For instance: the hypogastric has been seen by M. Blandin to send off the dorsal branches of the penis, and there to pass up on the side of the neck of the bladder, and then above the prostate gland to reach their natural situation. I have myself twice encountered this peculiar distribution, which is likewise noticed by M. Senn, and which is said by Vesalius, Sylvius, Highmore, Winslow, Burns, Tiedemann, Shaw, and others, not to be uncommon. Although mention of it has been omitted in many modern treatises on anatomy, Dr. Shaw cites an anomaly more remarkable. Still, and much more dangerous, a large artery, given off by the hypogastric, at the bottom of the pelvis extends from below upwards, and from behind forwards, upon the sides of the prostate, before it passed outwardly. In the operation for stone it was completely divided, and gave rise to a hemorrhage which nothing could arrest, and carried off the patient.

5. *The Veins* which surround the prostate, and which in old men sometimes form an abundant and crowded plexus, alone require special notice in this particular situation. It is unnecessary for more obvious reasons to examine the nerves and absorbent vessels.

6. *The Bulb*, and with it a small part of the membranous portion of the urethra situated between the two fasciæ, are separated from the skin only by a lamellar cellular tissue, not abundant; by the superficial layer of the aponeurosis; and the bulbo-cavernosus muscle. From the front of the anus also it is separated by a space of only eight or ten lines, and sometimes of six only. Its mobility is sufficient to allow of its being moved to the right side, or to the left, and at its sides it receives the transversa perinei artery. In a single case I have seen it extend as far as two lines from the anus, as if to close the recto-urethral triangle which will soon be mentioned.

7. *The Membranous* and prostatic portion of the urethra which is to be found above the horizontal aponeurosis, is enclosed in a space which it is essential accurately to define. Backwards it is circumscribed by the anterior

face of the rectum; below by the perineal aponeurosis; above, by the fasciæ pelvica; and the space itself is filled up by lax cellular tissue, small venous trunks, and by small muscles coming off from the pelvis to spread themselves out on the fore part of the urethra, called the muscles of Winslow. The several objects not being as dense as the tissue traversed by the urethra, the aponeurotic layer which exists on the back part, and appertains to the parietes of the ischio-rectal excavation, being generally pretty thin, it results from it that that portion of the urethra which is the least movable, is just that which is enclosed or strictured in the horizontal fibrous layer of the perineum.

8. *The Prostate Gland,* which plays so important a part in the different species of perineal operation for stone, resembles a cone of such very variable dimensions according to the age and condition of different individuals, that scarcely any thing decided can be said about it. However, the investigation of several anatomists, M. Senn amongst others, and those in which I was myself earnestly engaged, allow us as a general rule to say, that its antero-posterior diameter is from twelve to fifteen lines; that vertically it is from ten to twelve lines, and from fifteen lines to eighteen across; that is to say, it represents a pyramid whose base, hollowed out, receives the bottom of the bladder; whose point extends forwards to the membranous portion of the urethra; and whose anterior edge is sometimes deficient to create a fissure, in which the excretory duct of the urine is lodged. The gland seems to have developed itself between the mucous membrane and the truly fleshy portion of the urinary passages; and is enveloped in a layer, in which I have often detected fleshy fibres continuous on one side with the median membrane of the bladder, on the other with the evidently muscular layer of the membranous portion of the urethra, and on a third with the muscles of Winslow. More outwardly, the gland receives from the perineal aponeurosis a sheath of greater or less density, which we may call prostatic aponeurosis, and which as I have said, is continuous with the fasciæ pelvica; from the rectum it is separated merely by a thin layer of cellular tissue, in which fat is scarcely ever deposited no matter how *embonpoint* may be the subject. Its base ascends to about two inches above the anus, while its tip, on the contrary, inclines from it more or less. In front it is separated from the sub-pubic ligament by the muscle of Wilson, by cellular tissue, by flakes of fat, small veins, and by the pubio-prostatic ligaments, which separate the gland from the pubis for six or eight lines. The urethra which crosses it is generally nearer on its pubic than its rectal wall; so much so that M. Amussat thought it did not completely enclose this canal, but formed merely a groove for it, itself remaining below. This gentleman's error arose from taking the exception for the rule. What he asserts as a principle does indeed sometimes exist; but the contrary is not without proof either. I have in three subjects seen the urethra in its passage across the prostate, nearer the rectum than to the pubis. M. Senn mentions having once met with it near the posterior part of the gland, and M. Tanchou showed me a case in which it is almost entirely beneath. The following are the dimensions of its different radii, taken at its base, the interior of the urethra being taken as the centre. The pubic radius is usually three lines or four long; the rectal six or eight, the transverse eight to ten; and that radius which goes obliquely downwards and outwards ten to twelve; it being understood that the diameter of the urethra itself enters into the calculations.

Moreover, the *prostate* is crossed from behind forwards, and from without a little inwardly, by the *ejaculatory ducts* which open on its summit, or upon the sides of the *verumontanum.* The portion of urethra, which like itself is about twelve or fifteen lines long, and which it embraces, deserves in turn particular examination. Midway in its lower wall exists a cavity of more or less depth, as if it were divided into two on the median by the crista of the urethra. As the *verumontanum* is the organ to be avoided in cutting for stone, it is important not to forget its situation. As to the *vulvular* fold and the species of *sphincter*, of which some persons speak as in this neighborhood, they exercise so little influence over lithotomy that I shall defer any consideration of them until I come to the operations performed on the urethra itself.

The last point, the *development of the prostate*, is worthy of all surgeons' attention. Morgagni, Serres, and Sir E. Home, have thought that it was originally organized in two halves, by two lateral lobes destined after birth to become blended; andthat in the adult, a third was added to these two original portions. In this statement, judging from numerous observations made on the fœtus, and the investigations made by pathological anatomy in the adult, there is a double error. The prostate gland is formed of a series of glandules, which are developed simultaneously almost all around the urethra; and Sir E. Home's third lobe is nothing but a morbid tumor of the organ. This tumor, which is truly a very remarkable one, is far from being uniform, and from only appearing on the median line as the English surgeon asserts. I have met with eight in a single gland. It is a true pathological production, to appearance like the structure of the gland, but in reality much of the same nature as the fibrous bodies of the womb.

9th. *The recto-urethral triangle.*—Between the rectum and the beginning of the urethra exists a *space* through which instruments pass in many species of operation to reach the bladder. This space of which M. Dupuytren has said much and with great propriety since 1812, is bounded below by the integuments, backwards by the anterior surface of the termination of the rectum, and before by the membranous portion and commencement of the spongy portion of the urethra, so that it may be likened to a triangle whose base would be the skin, and its apex the posterior surface of the point of the prostate. Going from without toward the bladder, we encounter the subcutaneous cellular layer, the superficial perineal aponeurosis, blending itself with the base of the horizontal aponeurosis, the origin of the erector penis muscle, the end of the sphincter, the free portion of the bulb of the urethra, and one of the terminating branches of the transverse perineal artery; in other words, the recto-urethral space is filled up by the decussations of the sphincter ani, the erector-penis and transversus-perinei muscles, as well as by some branches of the transverse perineal artery, cellular tissue, and the mingling of the several aponeuroses.

§ 2. *Methods of Operation.*

Perineal lithotomy has been performed in so many ways, that to analyze the processes with any advantage, it is indispensable that they should be collected together in a groupe, and that those which have most analogy be assembled to constitute so many principal methods.

In some the stone is reached without any division of the urethra, while in others again the furthermost portion of this canal is always laid open by the instrument. To the first of these it seems correct to refer all that is said about lateral cutting; the method which seems to me to include the procedures of the ancients, of frere Jacques, Foubert, and others. The median operation, or that by the apparatus major oblique, or by the lateralized method of frere Come, &c., belong to the second genus.

1. *Lateral method* (*Cystotomy properly so called*).

a. *Procedure of Antyllus,* or of Paulus Æginetus, commonly called apparatus minor.

The description of lithotomy given by Celsus, has until the present time been the subject of apparently very faulty interpretations. From this it has resulted that the procedure called *methodus Celsianæ*, is not in reality his. For his principles, reference must be made to the Grecian authors. It will, perhaps, appear from the most extended researches, that it originated in ancient Egypt; whilst the true apparatus of Celsus belongs to the Alexandrian school. In as much as Antyllus has first clearly pointed it out, I think it proper to name it after this ancient author. To do it the surgeon passes two fingers into the rectum, and endeavors to hook the stone with them through the parietes of the bladder; whilst by pressing with his other hand upon the hypogastrium, or causing it to be compressed, the descent of it is favored. Having once seized the stone, he pushes it against the urethra, so as to make it project between the anus and scrotum, a little to the left of the perineum. He then with a small knife cuts all the soft parts down to it, in the direction of a line drawn obliquely from above downwards, and from before backwards, to the side of the left ischium; thus he opens the bladder and removes the stone through the aperture, by pushing it with the fingers he has kept in the rectum. When the fingers of the operator are insufficient to effect its expulsion, a sort of curette furnished with points in its interior is carried into the wound to hook the stone and bring it out.

This operation, from its great simplicity called *apparatus minor*, and subsequently by the name of the *Guidonian method*, because it had been forgotten until revived by Guy de Chauliac in 1363, was nevertheless described by a host of authors who preceded the one last named. G. de Salicet, for example, correctly describes it as Antyllus does; Paul of Egina, Albucasis, and most of the Arabian surgeons similarly understood it. Amongst others, Ali-Ebn-el-Abbas, thus expresses himself as to it, "You shall take the cutting instrument, and you shall cut," says he, "between the anus and the testes, *not on the median part*, but directing your excision on *the left part* of the thigh. The incision should be oblique, so that the opening may be large and proportionate to the stone."

A very analagous account of it is given by another author of the same period. Ebn-el-Coof, of whose work M. Clot, of Abou Zabel, in Egypt, has translated some fragments. I place this proceeding under the head of lateral cutting, or cystotomy proper, because in pursuing it we strike generally the side of the neck of the bladder, and not the urethra or prostate. It is easily conceivable that the fingers very seldom engage the stone in the prostatic

portion of the urethra, but that they merely place it in the vesical trigonal space, and that it is depressed towards the perineum, and laid bare by the cutting instrument through the parietes of the bladder itself.

By examination and operations on the dead body, I have learned that we then divide skin, cellular tissues, the posterior edges of the transversus perineal muscle, the superficial and horizontal aponeurosis, as well as the internal layers of those which cover over the ischio-rectal cavity; then the left side of the prostate and the lateral part of the neck of the bladder, without really cutting the urethra; that sometimes the bladder is cut two or three lines more outwardly, and again, on the contrary, very near the entrance of this duct; that it is a very easy thing to wound the vesiculæ seminales, and also the anus; and that in most cases the deepest part of the wound is not parallel with the superficial part after the operation.

The objections then which lie against this operation, are exclusive of the difficulty of seizing and hooking the stone with the fingers, of cutting exactly those tissues which lie over the stone, and of taking it out of so irregular an aperture; those of dividing the bladder itself outside of the prostate and thereby exposing to effusion into the cellular tissue under the peritoneum to urinary fistulæ, and above all of wounding the vesicular seminales, without perfectly protecting either the rectum or vessels of the perineum from lesion.

b. *Procedure of frere Jacques.*—I have said that the method of brother Jacques (I speak now of that which he originally adopted) belongs to the lateral operations.

This singular man, who was at first only a servant of Paulini, the Venetian, and who soon turned monk, wishing to imitate his master, commenced operating at Besançon, in the year 1695, and when two years later he came to Paris recommended to the canons of Notre Dame by many influential persons as possessing a new method of extracting calculi, went about it as follows. A cylindrical sound having no groove in it was introduced into the bladder, and enabled him to press out the neck of this organ on the left side of the perineum. Brother Jacques then plunged in a long knife between the anus and tuber ischii from below upwards, or from the skin towards the pelvis penetrated into the urinary bladder, enlarged his incision, carrying it obliquely inwards towards the symphysis pubis, and if it did not appear to him large enough when his lithotome was withdrawn, he increased it again with a second knife shaped like an erasure knife; then he passed in forceps to seek for the stone, and concluded like Pare, by saying to his patients, "I have operated upon you, may God cure you!" Every one must see at once, that by passing on one side of his catheter, brother Jacques avoided entering the urethra, and went at once into that portion of the bladder which is protected by the prostate or a little without the gland. Thus he cut much the same tissues as the Greek and Arabian physicians, with this difference, that his bistoury acted on parts regularly stretched; that he cut partly from within outwards, instead of acting on an irregular surface such as that of a stone; and that his incision was necessarily more equal, while its dimensions could be more easily altered according to circumstances.

The experiments made by the lithotomist Baulot, or as he was yet called Beulieu, on the cadaver at the Hotel Dieu before Mery, and at La Charite before Marechal, prove that he was far from always falling on the same parts

that in women he often divided the rectum or vagina; in men the vesiculæ seminales; and aimed particularly at the side of the bladder just where it enters the prostate to form the urethra. The shoemaker shown him at Fontainbleau by Duchesne, and on whom he operated in the presence of Felix, Bourdelot, Bessieres, and Fagon, and who in three weeks was walking in the streets, continued according to F. Collot to have urinary fistula. Of sixty patients entrusted to him in the two largest hospitals of Paris, only thirteen completely recovered; twenty-three died, the others remaining with fistulas, wounds of the rectum, &c., whence I think it follows that his method did not in reality differ from that of Antyllus, except in the staff which he used, and which enabled him freely to enter the bladder without the precaution of fixing the stone firmly against the perineum. As soon as brother Jacques had adopted the simple modification which was pointed out to him by Mery, Fagon, Duverny, and Hunault d'Angers, which consisted in grooving the convexity of his staff, this method of operation was no longer the same, and from this time only can be said to be enrolled among the urethra-prostatic methods, and to have become the origin of so many useful improvements. We shall return to it when on the lateral operation.

c. *Procedure of Raw.*—If it be true, as S. Albinus asserts, that Raw reached the side of the bladder without carrying his lithotome along the groove of the staff, then his method is that of the lateral operation, after frere Jacque's or the Arabians; but as we have no positive historical facts upon this subject it is needless to discuss it.

d. *The Procedure of Cheselden.*—It is very clear that the first procedure of Mr. Cheselden, the skillful surgeon at St. Thomas's Hospital, belonged to this category; since he simply laid bare the membranous and prostatic portions of the urethra, afterwards to divide the parts from behind forward, beginning at the neck of the bladder, and not following the groove in the staff.

e. *The Procedure of Foubert.*—The secret so inviolably kept by Raw as to the mechanism of his method, which after all was probably no other than that of frere Jacques, at first so violently criticized by him, induced many surgeons to endeavor to discover a method by which to perform what they then called lateral cutting, that is to say, cutting by the side of the body of the bladder. After seeking to attain their end by varying in every possible way the use of the staff, the length and extent of incision, &c. Foubert at last hit upon one different in appearance from every other, and which he supposed to be the one performed by Raw.

This surgeon began by filling the bladder with tepid water if the patient could not contain his urine long enough, passed in a long trocar at some lines from the tuber ischii, and carried it obliquely upwards, inwards, and forwards, into the reservoir of urine. The canula of the instrument instantly allowing of the escape of some drops of liquid outwardly, added to a want of resistance offered to the surgeon, served to indicate the entrance of the trocar into the bladder. This canula then acted as a director for Foubert's lithotome, which consisted of a bistoury four or five inches long, rather convex, and bent at an angle of twenty or thirty degrees on its cutting side near the handle. When it had entered the bladder, this knife was carried parallel to the ischio-pubic ramus, in other words, obliquely from behind forwards,

and from without inwards, so as to make a wound in the bladder and perineum equal to the supposed dimensions of the stone.

f. M. Thomas, surgeon at La Salpetriere Hospital adopting the same notions, thought it better to pursue another course. He plunged his trocar in the spot at which Foubert ended his incision, with the intention of dividing the parts from above downwards, and from within outwards, instead of acting in the opposite direction as was advised by the inventor of the method. Moreover, he finished by transforming into a species of concealed lithotome, the instrument with which he had effected the puncture, because, said he, the lithotome thus constructed would allow of giving to the wound a determinate extent, and greater certainty to the operation. Many patients were operated on by his method in the Parisian hospitals. It was submitted to the test also in England and in Germany. But it soon became subject to many objections. Most patients cannot retain their urine, and the injections however mild they may be, are always painful when carried to such a point as to distend the bladder.

The direction of the pelvic axis, and the deep situation of the urinal reservoir, do not permit of blindly passing a trocar through the perineum without danger. Nothing could be easier, in such a case, than to stray aside, backward or forward, so as to wound the rectum, vesiculæ seminales, ureters, the peritoneum itself, or to enter the bladder too high up in its body.

To all these undisputed risks one other must be added, which now alone could suffice to cause the method of Foubert to be rejected, could it ever be reproduced. It is, that the end aimed at is an extremely pernicious one. The incision into the bladder being to be made outside of, and above the prostate, between the peritoneum and fascia pelvica, it follows that the least drop of urine which should be effused at the bottom of the wound might give rise to inflammation of the cellular layer which clothes the pelvic excavation, and be speedily fatal.

It will be seen, that in the transverse or lateral operation nearly the same elements are passed through as in the procedures of Antyllus, Guy de Chauliac, and of brother Jacques; only that it inclines a little to the side, and that therefore it is perhaps rather more liable to give rise to incurable fistulæ, or to endanger the ureters or vesiculæ seminales. The mode proposed by Pallucci, of previously dividing the perineal layers, so as to allow the forefinger to detect the fluctuation in the bladder before it is punctured by the trocar, does not remedy the least even of these inconveniences.

Nor would the ingenious instrument invented by Lecat answer better, which is introduced closed, and in opening stretches the bladder at the basfond, and thus renders the introduction of the principal instrument more easy.

2. *Median Operation for the Stone.—Apparatus Major.*

Those procedures in which the incision comprises the greater or less part of the urethra, being in truth the only ones which ought to be adopted in cutting below the pubis, have likewise engaged more of surgeons' attention. Among them will be found the *median operation* by the *apparatus-major;* the *lateral operation,* or *perfected method of brother Jacques;* the *transverse operation,* and all their modifications

a. *Procedure of Mariano.*—As the method called that of Guy de Chauliac, had alone been recommended by the ancients, and did not appear calculated for any but young subjects, it was not possible that lithotomists should not have thought of some other.

That which, owing to the great number of instruments it requires, is called the "*apparatus-major*," remained for a long time a family secret. It appears to have been invented by some of the inhabitants of ancient Italian *Norcia*, who, under the common title of *Norcini*, acquired great reputation as operators during the 14th and 15th centuries. If M. Bonino, however, is correct, and the archives of Turin prove that its real inventor was Battista di Rapallo, who died in 1510, the master of Giovani. Be this as it may, Giovani de Romani is the first to whom history refers it; and it was published by his friend Mariano Santo about 1520 or 1530. It was probably known to A. Benedetti; for, after announcing that certain calculi may be extracted without a bloody operation, he says, "nunc inter anum et cutem, recta plaga, cervicem vesica incidunt."

It was raised to celebrity by the success of Laurent Collot, to whom it had been taught by Octavius Davilla, and who, owing to this, was appointed lithotomist to the court of Henry II. At this period of time the apparatus-major was still a secret to the public. Philip Collot and Restitut Giraud, who succeeded their relation, succeeded so ill in instructing ten students by order of the government, that their children would have alone retained it until Francis Collot had thought fit to publish the steps of the operation, had not the pupils of La Charite and the Hotel Dieu thought of making a hole in the floor of the operating room, and by watching their proceedings, discovered the secret.

It consists in the following process: A grooved staff carried into the bladder allows the perineum to be depressed a little to the left of the raphe, and not as Heister states exactly on the median line. With a lithotome, like an immense lancet, the surgeon makes his incision into the skin, the cellular tissue, and the muscles, from the root of the scrotum to some lines from the anus, and which incision crosses the bulb of the urethra, and so strikes upon the groove into the staff. A director (a sort of stem, formed of a male and a female branch, differing from one another in as much as that the first ends by a rather flat and smooth extremity, whilst the other is forked in the same direction) is then carried instead of the lithotome quite into the bladder. The staff, now useless, is forthwith drawn out. The female branch of the director, which until now remains outside, is then slipped by the assistance of its bifurcation upon the square edge of the male branch into the interior of the urinary pouch. Fixed thus one upon the other, the two branches of this instrument allowed the surgeon to dilate the wound, by separating them with their outer ends, which terminated in a cross to render manipulation more easy; but their principal use was to direct the forceps in seizing the stone. Moreover, a common gorget, and even another instrument called a dilator, formed of two branches jointed like scissors, which were introduced closed, and opened by pressing on the rings affixed to their handles, were substituted occasionally for the one before mentioned.

The apparatus-major, practised by following to the letter the instructions given by Mariano Santo, is one of the very worst operations which has ever been invented. The incision, evidently, only bore upon the spongy portion, or at most upon the membranous portion of the urethra. The dilators could only

widen the wound by lacerating the prostate. The urethra itself was sometimes burst entirely, and the rents extended even as far sometimes as the neck of the bladder and vesiculæ seminales. Bruising the verumontanum, tearing the ejaculatory canals, bring with it fistula, incontinence of urine, swelling of the testicles, and even impotency frequently. The external incision prolonged too much in front, facilitated infiltration of blood, pus, or urine into the scrotum; and the bottom of the wound, moreover, became in many a starting place for purulent deposits, which passed in the direction either of the pelvis, around the rectum, or on the upper parts of the thighs. Altogether the operation was so excessively painful and dangerous to such a degree, that according to the statement of the editor of the works of F. Collot himself, it was scarcely possible to save one third, or half of the patients who had the courage to undergo it.

However, it would be unjust to attribute to the apparatus-major all the reproaches which, from the detail just given of the steps in it, it may seem to deserve. It had in fact undergone many changes in the hands of different operators. For instance, since the time of Dionis and La Charriere, the conductor and dilator were used no longer; after freely incising the urethra they merely conducted a gorget upon the groove of the staff to beyond the neck of the bladder, which gorget afterwards served as a guide to the common forceps. It had been still further simplified by the surgeon-in-chief of La Charite, M. Marechal. After making his first incision like Collot, he passed in his lithotome with a complicated see-saw motion to the bladder, performing what was called by surgeons at that day the "*coup de maitre*," in such a way as to divide the whole thickness nearly of the prostate in its posterior radius. D. Scacchi and C. De Solingen had before formally advised cutting all those parts which Mariano Sarto preferred to tear. It is evident that in this way Marechal cut the bulbous part, the membranous and prostatic portions of the urethra, and consequently that he had an aperture of eight or ten lines in the neck of the bladder which would allow of the easy passage of bulky stones without the slightest rupture. This surgeon obtained numerous successful results, and concluded his operations with wonderful celerity. Dilatation with the finger, as mentioned by De la Faye, had certainly been less formidable than the instruments of Giovani, but could not compare with the modification of Marechal.

b. *Procedure of Vacca.*—Regarded in this light, the apparatus-major had so lost its terrors that a surgeon of eminence has, in later years, reintroduced it as a method of his own invention. After for a long while extolling and practising the recto-vesical operation, Vacca Berlinghieri at last replaced it by a procedure which differs but little from that of Mery. The Tuscan surgeon makes his incision upon the median line as did Mariano, comes down to the membranous part of the urethra with a common bistoury, then inserts in the groove of the staff the beak of his "bistoury lithotome," which he pushes into the bladder, and lastly draws it from within this organ outwards, raising his wrist so as to divide the prostates as extensively as may be wished.

Another alteration of the median operation is contained in a thesis defended at the commencement of this century by M. Treyheram. The urethra is opened, and also the prostate, from before backwards; a dry carrot is then placed every morning in the bladder through the wound, and the stone only

extracted at the end of some days. The writer states that M. Guerin of Bordeaux, the inventor, has obtained from it the happiest success; and the papers of the country have again recently taken notice of it. The median method of cutting for stone, when reduced to its greatest simplicity, offers but one indisputable advantage, that of not giving rise to any danger from hemorrhage. Vacca, who in addition to this assigns to it the merit of allowing the stone to be extracted in the widest point of the lower strait, could never have considered of his assertion; for in this respect it offers nothing more than a host of other procedures belonging to lateralized cutting. As improved by Mery and by Vacca it is less painful, more reasonable, and in every point of view infinitely superior to the old plan as it came from the hands of Mariano; but it is not the less of all the most threatening to the rectum, and does not guard against wounding the ejaculatory ducts. Moreover, as it divides the prostate from before backwards in the direction of one of the smallest radii of the gland, it is not really worthy of the eulogiums recently lavished upon it by the professor of Piso and his countryman M. Balardini.

3. *Oblique, or Lateralized Operation for Stone.*

Owing to a *mal a propos* confusion between the operation described in the works of Celsus, with that which is described by Paulus of Egina, and Antyllus, the lateral method as first performed by brother Jacques has ultimately been confounded with the lateralized mode of cutting on which so much labor has since been bestowed. A great difference exists between the modes of performing them. In one, the principal object in the incision is to reach the side of the neck of the bladder without necessarily involving the urethra; in the other, on the contrary, the posterior portion of this canal is always divided, whilst the bladder itself may be most strictly avoided. The lateralized method consisting essentially in an incision of greater or lesser obliquity into the prostatic portion of the urethra, including in it a greater or less extent of the membranous portion of the same passage, the only procedures evidently which belong under its head are those in which the operator employs a grooved staff to direct his cutting instrument into the urinary bladder.

a. *Procedure of Franco, or of d'Hunault.*—So little is the conception of the oblique method, the right of frere Jacques, that this monk attained to it only as a consequence of the representations of his antagonists, and after it had been neatly set forth by Franco and Fabricius Hildanus. Franco says distinctly, that to incise the perineum in lithotomy, a curved, grooved staff must be introduced previously into the bladder; that this staff must act as a director to the bistoury, and that the neck of the bladder should be divided obliquely from within outwards towards the ischium. True, he wishes it to be made on the right side; but it is possible that by this expression he means the right side of the surgeon, which corresponds with the patient's left side. G. Fabricius evidently followed the same advice previously also given by A. de la Croix. It is to Hunault of Angers notwithstanding, that we owe our knowledge on this subject. Plates which he caused to be executed, but which were never published, show that with a grooved staff we may always cut with certainty the same parts, and it was in consequence of having adopted his counsels that brother Jacques succeeded in 1701 in cutting thirty-eight pa-

tients with stone at Versailles without the loss of a single one, and also the twenty-two persons collected by the Marechal de Lorges at his hotel in 1703, that he obtained such brilliant success in Holland, and afterwards on his return to France.*

b. *Procedure of Garengeot and Perchet.*—Garengeot—who made the discovery during the course of some examinations which he was making on the dead body with Perchet, a surgeon at La Charite, and who put it in practice upon a child nine years and a half old, in the year 1729, whilst Morand had gone to England to teach it to Mr. Cheselden—is the first who seems to have re-established it upon the grounds first laid down by Hunault. The staff introduced into the bladder is entrusted to an assistant, who presses it upon the left side of the perineum to make it bulge in that direction. The surgeon makes an oblique incision from the *raphe* towards the middle of the space which lies between the ischium and the anal aperture with a common bistoury or lithotome. This cut, which should begin an inch above the anus, goes through skin and sub-cutaneous tissue. The left index-finger then serves as a guide to the cutting instrument, whilst the other tissues are layer by layer divided, and the urethra laid open. The lithotome slipped from before backwards, and from above downward, upon the groove of the staff enters the bladder, crossing obliquely the prostate outwardly from right to left; after which the surgeon makes use of it for enlarging the wound by withdrawing and pressing upon it with more or less strength. With a view to favor its entrance, as soon as the membranous portion of the urethra is opened, the operator requests his assistant to lower the handle of the staff, or he does it himself, so as to raise the concavity behind the pubis, whilst at the same time he inclines the wrist of the right hand a little downwards. In this way he runs no risk of straying, and the bladder is in no danger whatever of being wounded.

c. *Procedure of Cheselden.*—Morand in his description of the process of Cheselden has given nearly a similar idea of lateralized cutting as had Garengeot, save that it would seem that his principal intention was, after dividing the prostate, to spare as much as possible the other tissues, and to make his wound resemble a sort of oblique canal from behind forward, and from the bladder towards the perineum. But Cheselden has several times modified his method of operating. His first method I have already described when speaking of lateral operation, and the second is that described by Morand. The third at which he stopped is very different from the notion generally entertained in France. The English surgeon in every case extends his external incision to a length of two to four inches, and it always fell betwixt the bulbo-cavernosus and ischio-cavernosus muscles, so as to lay bare the urethra to the summit of the prostate.

The second stage of his operation comprised the incision of the deeper seated parts, which the former had denuded. To accomplish it Cheselden

* Sabatier is in error in saying that brother Jacques died in 1713. Having arrived at L'Etendonne from Rome, or, according to Norman, at his village, Arbagne, in June, 1714, he went to pass several months at Besancon, and then lived long enough among the Benedictines to build there a small house, which he afterwards quitted to go and live with his friend L. Decart, where he died aged 69 years; and as he was born in 1651, of course in the year 1720.

pushed forcibly the anus backwards and to the right side, by introducing the forefinger of his left hand into the hinder angle of the wound, then on the nail of this finger passed in a slightly concave bistoury, following the anterior face of the rectum up to the neck of the bladder, struck upon the groove of the staff to divide the whole extent of the prostate gland from behind forwards, and from below up, by drawing towards him his lithotome, with its cutting edge turned towards the pubic articulation.

This procedure of Cheselden's will be seen to be quite distinct from the oblique or lateral operation for stone, as practised by French surgeons. It encounters, it is true, the same parts as that of Garengeot; yet, while it bears the semblance of more perfectly protecting the rectum from injury, adds in reality to the difficulty of manipulation.

d. *Boudou*, who performed the lateralized operation, perhaps before ever it had been described by any one in Paris, adopted a method which differed from that of Mery, only in the direction which he gave his incision. De La Faye states in his addenda to the Treatise of Dionis, that Boudou caused the handle of his staff to lean towards the right groin, and that after having cut into the membranous portion of the urethra, he plunged his lithotome along the groove of the staff, then raised up towards the pubis beyond the neck, and divided the prostate obliquely to the left, drawing the cutting instrument towards himself.

e. *Procedure of Le Dran.*—Le Dran one of the most learned practitioners of the age, had also his own particular method of operating. When he had cut into the urethra, he introduced a thick grooved sound into the bladder, immediately withdrew the catheter, and ended by dividing the prostate with a convex bistoury "en rondache, shield-shaped," which was about six lines in width. Notwithstanding that it is insignificant in itself and fitter to complicate than simplify the operation, this modification has had its partisans; and even now has some still in Great Britain. Allan Burns, for instance, adopts the principle, preferring however the common lithotome or bistoury to the instrument of Le Dran. Mr. J. Bell, who was of the same opinion, incises from the prostate towards the first opening of the urethra, as Cheselden did, instead of following Le Dran, and carrying the bistoury from before backwards; and Allan who, like his countrymen also carries in the bistoury to the staff passing behind the prostate, prefers withdrawing them both together, keeping the two instruments firm one on the other, as is commonly done in operating for fistula in ano. It is difficult to discover in what respect the cutting for stone is rendered less dangerous or more convenient by either of the above shades of difference from the principal operation.

f. *Procedure of Lecat.* A method of operating for stone, in the oblique or lateralized way, which at the time made some impression on the profession, is that of Lecat. The sound used by this operator did not terminate at its straight end by the usual flat surface, but by a handle. The instrument with which he laid bare and incised the urethra had lateral notches near its back, and was called by the inventor his "uretrome." Lecat conveyed another one, ending in a blunt extremity, to the assistance of the former as far as the groove in the staff to cut through the prostate, very much as was done by Cheselden in his second procedure, or that described by Morand. However, the edge of this second instrument, called cystotome, was never to go beyond

the vesical tubercle which exists at the entrance of the urethra, for which very reason the name of cystotome, is most singularly inappropriate to it. Lastly, the surgeon of Rouen, for a short space conceived the idea of substituting a sheathed lithotome in place of his cystotome, and to which he gave the appellation o. cystotome gorget. The original which he adopted was a large incision externally, a small one within; whence we see that he foresaw the danger of going beyond the limits of the prostate, and preferred rather to dilate the entrance of the bladder than to incise it. But to accomplish the ends aimed at beneath the thought, the instrumental apparatus was unnecessary, and his method, although he derived indisputable success from it, was not generally adopted. Some practitioners indeed have continued to pursue it. Pouteau reaped such successful results from it with a very slight modification, that in some of the Lyonese hospitals it is still frequently practised. A surgeon of Venice, M. Paiola, who has increased its complexity, by adding a third instrument to those of Lecat, has it is said recurred to it five hundred times and never lost a single patient! This assertion is so strange that but for Langenbeck speaking in eulogistic terms of its author it would be undeserving the least attention. It will be seen in a thesis by M. Dumont, that in the hospital at Rouen, M. Flaubert, also follows the axiom established by Lecat, and that according to him a small incision and a free dilation, is a maxim from which no surgeon should ever deviate. M. Delpech was equally of opinion that it was safer to dilate, and even to tear the neck of the bladder, than to cut it freely, and that the precept of Lecat on this subject ought to be law. Beneath it there is an important truth which of late years only could have been properly estimated, because until then the anatomical reason had not been distinctly shown; it is, that lithotomy confined to the circle of the prostate is infinitely less dangerous than that in which the incisions exceed the limits of this gland.

g. *Procedure of Moreau.* A surgeon at the Hotel Dieu, in Paris, M. Moreau, who died in Paris, 1786, discarded all these complications, and performed the lateralized operation in the following way. To a certain extent his lithotome resembled the old one of Collot. He cut very freely the skin and cellular subcutaneous tissue; opened the membranous portion of the urethra; raised the staff behind the pubis, and at the same time plunging his bistoury into the bladder; strongly elevated his right wrist to cut the prostate obliquely, and then depressed it to carry backwards the cutting edge of his instrument, as he brought it out at the external opening. His idea was to make a large opening into the neck of the bladder, so as thence easily to extract the stone, a still larger opening in the integuments to avoid infiltration or abscess, and to cut but very little of the parts intermediate; to avoid the arteries of the perineum which are lodged principally in them, and likewise to avoid the rectum, so that his wound must have resembled a double triangle whose narrowest part was in the centre of its length.

h. *Procedure of frere Come.*—A modification of the lateralized operation for stone, which actively engaged professonal minds, was that which brother Come proclaimed himself the inventor in 1748.

This monk contrived an instrument, which being introduced closed into the bladder through the incision in the urethra, is open by exerting pressure on the bascule of its outer extremity, and as it is withdrawn cuts the pro-

state from within outwards. This instrument since known as the sheathed lithotome, at first appeared to offer numerous advantages. Its handle cut into facets, numbered 5, 7, 9, 11, 13 and 15 is so arranged that by bringing off the numbers towards the side of the bascule, one is sure of having a corresponding opening toward the vesical extremity of the instrument. Thus it is known beforehand, and with great certainty that the neck of the bladder will be divided to an extent of 7, 9, 11, 13 or 15 lines, according as one or the other of these dimensions shall have been pitched upon before it is introduced. Franco speaks of an instrument very much of the same kind, and Bienaise's concealed bistoury does not differ much from it. It was objected to it, that it was liable to escape from the groove in the staff; to slip between the bladder and neighboring parts; to wound the rectum whilst it was being withdrawn; to cut the pudic vessels; and lastly, to pierce the bladder itself, after it was emptied through the wound in the perineum.

To do away with the latter objection, its point was blunted by Caguet, a surgeon at Rheims. However, as it finally appears to possess merely the advantage of cutting the same parts always to a determinate extent, which are divided by other lithotomes, it has with some show of reason been alternately lauded or condemned. Surgeons but little accustomed to capital operations, and who are not sure of their hand, who are not very perfect in the anatomical details of the perineum, but who nevertheless venture to cut for stone, may and even ought to give it a preference.

The lithotome gorget which Bromfield wished to substitute for it, composed of two pieces movable on one another, is incomparably more defective. The modifications made on it by Mr. Evans of London, and several operators in France, which are almost all confined to its bascule and handle, are too unimportant, too evidently matters merely of taste, for me to stop to discuss them.

Brother Come performed his operation after the usual method of lateralized cutting as far as the division of the membranous part of the urethra. The lithotome passed along on the nail of the left index finger into the groove of the staff, was then to be engaged closed in the bladder. Then the surgeon himself took the staff in his left hand to depress its handle and elevate its concavity behind the pubis, whilst with his right hand pushed on the point of the sheathed lithotome in the groove, which thus passed into the bladder, and the staff, now no longer useful, was withdrawn at once from the urethra. Having anew assured himself of the existence of the stone, which can be felt easily with the end of the lithotome, the operator takes hold of the shank of the instrument with his left forefinger and thumb semiflexed; opens it by pressing on its bascule with the right hand; rests the back of the instrument firmly against the symphysis pubis, a little to the right side; directs the cutting edge of it to the left and backwards; draws it forth, raising its handle moderately until its blade has cleared the prostate; slackens the bascule at this moment; allows it to reclose by degrees; and lowers it more and more, and in such a way, that from the neck of the bladder to the integuments its cutting edge shall as it were have described a half circle, the convexity of which should be in front, nearly as in the procedure of Moreau.

i. *Procedure of Guerin.*—Brother Come is far from being the only person who has proposed a particular instrument for lessening the dangers of litho-

tomy. A host of others have since his been invented, tne object of some of which has been to render opening of the urethra more certain; of others to divide the prostate neck of the bladder with less hazard. Among the first are many species of staves; for example that of Guerin, so constructed that when once placed, its external extremity is sufficiently depressed to be directed opposite or to face its most convex part, that is to say, the groove of its urethral portion. It is besides ended by a sort of perforated head, through which may be carried a long trocar canulated on its inferior surface, and which passed upon the perineum necessarily falls of itself into the groove of the staff. We see thence that the incision in the soft parts externally becomes extremely easy, and that the opening in the urethra offers not the least embarrassment. In all other respects the operator acts as has been described when speaking of median cutting. An instrument differing from that of Guerin in having two halves jointed externally by a hinge, has been employed in England by Mr. Earle, with similar views to those of the Bordeaux practitioner. Deschamps describes a third also belonging to this list.

Were the opening into the urethra the really difficult point in the operation, this species of sound would perfectly answer the end for which it was designed. But let a surgeon have ever so little skill or knowledge of parts, it is never at this stage of lithotomy that he stops short. Consequently the instrument of MM. Earle and Guerin will remain merely things of caprice or individual usefulness, as so many others have done. The common staff on which Sir C. Bell has caused the groove to be put on one side, so as to be able while holding it in the median line, to cut obliquely to the left when we reach the prostate, seems really only calculated to increase the difficulties of the operation. As to Mr. Key's staff, which is straight or scarcely curved for an extent of half an inch towards its beak, it does not seem to me to deserve any real importance, nor to possess any indisputable advantage over the rest.

The instruments contrived to facilitate opening the bladder and make it more sure are of two kinds. Some in fact nowise differ save by feeble shades of distinction from common bistouries, whilst others are indeed instruments peculiar in their nature. In this way the lithotome of Cheselden, a little concave on the back, has been altered in the hands of M. Dubois, into a little knife with a solid handle scarcely different from the convex bistoury. In England, M. Blizard employs a long, narrow bistoury, with a firm handle like that of the French surgeon, whose point ends towards the back of the blade by a sort of blunt stylet. Klein, Langenbeck, Kern, Græfe, in Germany, have each a lithotome which ranks like the former, in the class of simple knives or of bistouries of varied forms; but to whoever will look closely into them it is evident that all this is entirely optional, and that it is indifferent whether the one or the other be adopted; any of which may be replaced perhaps advantageously by a common bistoury, or probe-pointed one. It is long since M. Dupuytren, and some English surgeons alike asserted this fact, that when directed by an able hand, a common straight bistoury is quite as capable as the most complex lithotome of penetrating the bladder and of cutting the prostate on being withdrawn in a suitable direction. We see also, by reference to the work of Sabatier, that the surgeon-in-chief at the Hotel

Dieu has several times operated for stone, by plunging the straight bistoury by puncture as far as the groove of the staff, then into the bladder, so as to divide by its withdrawal the prostate and all the tissues which constitute the perineum together. This procedure, which reduces lithotomy to the simple opening of an abscess, is easier than one might imagine. It would appear that in some cases M. Lisfranc had adopted it; and in teaching surgical operations to my pupils, I have frequently tried it on the dead body. As however, it can have no other advantage than that of rendering the operation more quick of performance by a quarter or half a minute, I do not think that prudence justifies the establishment of a rule on a like act of dexterity and skill, so that if a bistoury be used the urethra should be incised as is usual, and the knife be then slipped along the groove in the staff, as is done by all other lithotomists.

The special instruments for this purpose of which it remains for me to speak, are known under the name of gorgets.

j. *Procedure of Hawkins.*—The first gorgets employed in lithotomy were simple canals (*gouttieres*) ending on one side by a stylet or probe point, and at the other having a sort of handle. They were used to supersede staffs, and they are so still to facilitate the introduction of forceps in almost every species of operation. When in this form their edges are round and blunt, so as not to endanger the parts. It was not before the middle of the last century, that an English surgeon named Hawkins conceived the idea of metamorphosing the gorget into a lithotome, that is to say, to make it into a cutting instrument by sharpening one edge near its point.

This instrument, which most English surgeons adopted, is used in the following way. The membranous portion of the urethra being once open, the surgeon seizes the gorget by its handle, carries the knob at the point into the groove of the staff, and pushes it into the bladder, being careful not to let go this latter instrument, which is elevated behind the pubis by a swinging motion, as the gorget is dividing the left side of the prostate. The apparent simplicity of Hawkins's gorget, did not however prevent even its admirers from discovering its defects. Mr. Bell finding that its blunt part was too broad, had it contracted to prevent it from bruising or tearing parts. Desault who did away its concavity, besides adopting Bell's modification, placed the knob quite straight on the blunt edge. Blicke, fearing that it might stray out of the groove of the staff, and pass between the rectum and bladder as Sir A. Cooper and Mr. S. Cooper state they have themselves often witnessed, so arranged the knob as that it would not escape before it had reached nearly to the end of this staff. That of Mr. Abernethy represents as it were, a triangular canal, as is seen also in that of Cline, or else a cylindrical demi-canal like that of Hawkins. Dorsey has given us an engraving of one, the blade of which takes off easily, and is of the same width throughout its free extremity obliquely cut like the kystotome of Desault, and being the only cutting edge. Lastly, Scarpa who declared himself a patron of the instrument, strove at great length to prove that a gorget ought to have a very narrow cutting blade two lines towards its knob, growing larger and larger until it have acquired a transverse diameter of about seven lines, and that this cutting edge ought to be bent at an angle of sixty-nine degrees on the edge which acts as its back, so that in cutting the prostate it might make a wound,

the angle of which should also be at an inclination of sixty-nine degrees, as regards the direction of the urethra. Some English surgeons, amongst others Messrs. Dease and Mair, thought that using with it the staff of Le Dran gave more certainty to its use. This proposition was not, nor did it deserve to be followed. In France, gorgets have found but very few supporters. M. Roux is almost the only man in Paris who uses them. The least reflection serves to show the unimportance, I had almost said insignificance, of the variations in form to which this instrument has been subjected. It is the gorget as a particular instrument, and not such a form of gorget in particular, which we are to examine; and I am surprised that authors of such repute should have involved themselves in disputes upon this subject. Certain it is, that with a gorget the rectum or pudic artery will never be wounded, unless some anomaly exist in the anatomical arrangement; that the limits of the prostate either can never be passed; but as the whole of this advantage arises from the small extent of wound it makes, it is clear that the same might be obtained with any lithotome whatever, if a wound of six or seven lines only were to be made. The inconveniencies about the instrument are, that whatever be the size of the stone it always makes a passage of the same length; that it is more likely than any other instrument to wound the posterior wall of the bladder, or even to go through the sac, as Mr. Earle says he has seen done, and above all to divide the tissues by pushing them before it; in separating the different layers of the perineum from one another, to relax them in some measure instead of pressing them downwards from above, stretching them as does the sheathed lithotome for instance, and almost every cutting instrument employed by different operators in this second stage so as to dilate and even bruise as it divides; of obliging the operator to have several gorgets of various sizes; and of never allowing of any incision of more than eight or nine lines. Perhaps the least disputable advantage which it has, although it has not been mentioned, is to be found in the direction which it gives to the incision of the prostate, one of a semilunar shape whose concavity looks backwards and to the right, and the arch of which having a cord of about seven lines in length, ought to stretch two or three lines at least without tearing, when extended during the extraction of the stone. Under this view Desault's gorget is evidently the worst constructed of any; for to attain this end it ought, augmenting in width on its cutting side, to preserve its primitive canal shape, or else that of a half canal. Moreover, in this way it would cease to belong to the performance of the lateral operation, or that properly called the oblique. The incision would be rather a transverse one, directed towards the left ischium, whence arises a fresh inconvenience; that of acting on a shorter radius of the prostate than that which should be cut in the procedures of brother Come, Cheselden, or Garengeot.

k. *Procedure of Thomson.*—The deviation from the line first indicated in lateralized operation is not after all the only one that has been suggested. Dr. Thomson, in 1808, wishing to avoid cutting the rectum and perineal arteries, thought of making an incision with a common lithotome, not downwards, but up and outwardly a little when a backward incision of some lines did not seem to him sufficient for extracting the stone. At about the same time M. Dupuytren, desirous of avoiding the same parts, thought proper to conduct his incision almost directly upwards; that is to say, when he reached the bladder

he turned the cutting edge of his bistoury, or of Come's lithotome up a little to the right, parallel to the ischio-pubic ramus, as if to reach the symphysis. These modifications were properly abandoned by their inventors on considering that then the prostate is divided in its least thick direction, that its limits must invariably be passed, and still further, because the stone has to be extracted through a point of the inferior strait still narrower than in the oblique posterior operation.

1. *Procedure of M. Boyer.*—M. Boyer, who almost always uses the sheathed lithotome and who is said to be very happy in his operations for stone, makes his incision in none of the directions which have been pointed out. Instead of resting the back of his instrument towards the symphysis, he holds it firmly against the ramus of the pubis and ischium of the right side so as to be able to direct its cutting edge almost completely across, and to the left during its withdrawing to divide the prostate from within outwards like every one else. In doing this the rectum and pudic artery are in no danger any more than the transverse perineal artery whose direction is almost parallel to that of the incision, whilst the superficialis perinei is the only one which can be injured. This is a modification against which no reproach could be urged, were it not that the prostate has to be divided in the direction of one of the shortest radii, and that the incision cannot be of more than seven lines in extent without going beyond the boundary of the gland. The lithotome thus managed answers all the purposes of the gorget without its objections.

Remarks.—If it be true that the difficulty to be got over in the oblique operation is to open the prostate as widely as possible, keeping at the same time within the limits of its outline, evidently the only incision to be adopted is that which proceeds downwards and outwards. With this supposition the procedure of Dr. Thomson, and that which M. Dupuytren has tried to bring into use are unworthy of being discussed. The rule adopted by M. Boyer of allowing the cutting edge of the bistoury to lean a little towards the ischium is infinitely a better one. For the loss of a breadth of one line in the incision into the prostate we derive undoubted advantages as regards the arteries and the rectum. As to the incision made after the manner of Boudou, of Garengeot, of Morand, of Le Dran, of Moreau, of Dubois, and of Messrs. John and Chas. Bell, and of all those who prefer the bistoury with more or less modification to particular lithotomes, and who seek to open the neck of the bladder extensively, it is a matter of indifference whether the one or the other be followed provided that care is always taken to extend sufficiently the opening into the integuments and other constituent parts of the perineum. Two circumstances present themselves for consideration in the method proposed by Lecat; 1st, the instruments he uses, for which any others may as well be substituted; 2d, the idea of only making a small incision into the neck of the bladder. This is the only distinguishing point in Lecat's operation. De la Motte had already maintained that there was less danger in dilating, and even in tearing the entrance into the bladder to a certain extent, than in incising it; and we can scarcely be allowed to dispute the justness of the remark. The error into which its defenders have fallen is that they have not understood the essential reason for it, and have carried their extension beyond moderate bounds. In fact, the small incisions of which Lecat speaks are better than large ones, only as they are confined within the limits of the pro-

state gland; and it follows therefore that no other operation for stone will be more dangerous which does not extend beyond this boundary. I have in some preceding pages expressed my opinion as to the gorget and its various forms. The instrument of brother Come remains for my consideration; and no one can deny to it the possession of great certainty, great simplicity of mechanical construction, and the capability of being used by most operators more easily than the bistoury; only as we shall see by the sequel it may well be superseded by the probe-pointed bistoury. The principal dangers of oblique cutting originating in the risk of wounding the rectum, pudic-artery, and the transverse or superficial arteries, all instruments except the gorget are in this respect equally objectionable. If one is careful to examine the state of the rectum by the introduction of the finger into it, and careful also not to make the deep wound too large, and the lithotome be handled with a little dexterity, the rectum will not be perforated. The pubic artery being always situated along the outline of the pubic arch, is consequently far beyond the prostatic limits, and runs in reality no risk of being wounded. The seat of the superficial artery being in the subcutaneous layer would be so easily seized, twisted, tied, or cauterized, that opening it could never be a thing of any importance. The transverse perinei, usually a very small vessel, can only be avoided with certainty by making an incision into the urethra, which shall not begin too near the bulb or too far from the prostate. Happily the bleeding which follows its division is seldom abundant enough to become serious. With this view of the case then there can be no danger in practising the lateralized operation for stone, unless in case of an anomalous distribution of the vessels or of their being of excessive size. A much more vexatious difficulty is that we cannot obtain by it an aperture of more than ten or twelve lines at most; too small therefore to admit of the removal of voluminous calculi.

With a view to obviate this objection of real weight, notwithstanding all procedures, and all operations, the following method has been set forth.

4. *Transverse* (*bi-lateral or bi-oblique*) *Cutting for Stone.*

A fresh interpretation of the passage in Celsus in latter years has given origin to a new operation for stone. When speaking of the extraction of calculi, the Roman author advises that there be made "juxta anum, cutis plaga lunata, usque ad cervicem vesicæ, cornibus ad coxas spectantibus paululum;" then, that at the bottom of the first wound the instrument be carried in to make another which should be transverse, and open the cervix-vesicæ by going down to the stone. Now it is this passage, until lately so construed as to have given rise to lateral cutting, lateralized cutting, and the apparatus-minor, formerly described by the Greeks and Arabians, which interpreted truly constitutes the principle of this new procedure.

The words *plaga lunata*, and *plaga transversa*, had, it is true, more than once puzzled commentators on Celsus; but by substituting the singular for the plural, and translating *ad coxas*, by 'towards the thigh,' they fancied that they had got over the difficulty. In vain did Davier, in the year 1734, April 15th, sustain at Cochu, before the faculty of Paris, that in Celsus's apparatus a crescentic incision is made in the skin near the anus, the ends of which

crescent turn towards the thighs; in vain did Heister cause Ilsman to repeat the same thing in November, 1744; in vain did Normand de Dole complain of the slovenly way in which the works of the ancients were perused, and recalled the fact to mind that in the Celsian operation the crescentic-shaped incision ought to be situated near the anus with its horns turned rather towards the thighs of the patient; in vain the same interpretation was again urged by Macquert in a thesis defended in April, 1754; by M. Portal in his Precis de Chirurgie, published in 1768, and by Deschamps himself in his Treatise on Lithotomy; no one gave himself the trouble to turn it to any account. A second ambiguity which Bromfield vainly endeavored to clear up and remove, was to know whether the words *cornibus spectantibus paululum ad coxas* were to be construed to mean a semilunar wound whose ends were to be turned forwards rather than backwards. Every author whom I have cited has, it will be seen, adopted the first version. Bromfield alone inclined to the second, which in truth seems to be the correct one; for *coxas* among the ancients was generally applied to the large bones of the pelvis, and the ischium in particular. Be this as it may, the question has been considered under its proper light only since the beginning of the present century. In the year 1805 M. Morland of Dijon mentioned in a thesis some attempts made by M. Chaussier on this subject, whence it resulted that a semilunar incision with its concavity looking backwards allows of an easy entrance into the bladder and of extraction of a stone. Again this was a lost labor, and Chaussier himself had forgotten his own investigations, when they were reproduced in 1813 by Beclard, almost in M. Morland's words, and with as little success. The convincing and forcible reasons urged by M. Turck in 1818, at Strasburg, in favor of the same principles, again failed to awaken the spirit of inquiry

But, in 1824, M. Dupuytren engaged in an attempt to render lithotomy less dangerous, entertaining the same ideas as MM. Chaussier, Beclard, and Turck, immediately almost put them in practice on a living subject, and was speedily convinced that there existed in it an inestimable way of operating for stone. Beclard, not quite so sanguine, but who had never forgotten the subject, and who even, according to M. Olivier of Angers, had himself some few times performed it, recapitulated anew its advantages to the Academy, whilst M. Dupuytren at the Hotel Dieu was making its importance be fully felt. Since that period numbers of surgeons have adopted it, and it is now considered as one of the best methods, if even it may not be regarded as absolutely the very best of all.

a. *Procedure of Chaussier.*—It is shown by the essay of M. Morland, that Chaussier, in conjunction with M. Ribes, began by incising all the soft parts between the anus and the bulb of the urethra with the point of a scalpel; that he had entertained thoughts of having a double grooved staff, one groove on the right side and one on the left, so as to be able to divide the membranous and prostatic portion of the urethra only on one side, or successively on both, if it seemed to be rendered necessary by the size of the stone; that in his opinion the staff might be superseded by the grooved staff as advised by Le Dran, because in carrying it by the wound it was easy to cut upon it to the left and then to the right; that he had thought besides of a sheathed lithotome with two blades, and of the sheathed scalpel of Louis; but that he was

also cautious to observe that in such a case, the best of all was intelligence, guided by exact knowledge of situation and nature of parts.

b. *Procedure of Beclard.*—The instrument selected by Beclard was a species of rather wide gorget, scarcely concave, cutting on both sides, and ending in a little tongue in its convex direction. He mentions likewise the double lithotome, leaving every one at liberty to adopt or dispense with it at pleasure. He had also constructed a knife whose blade was shaped like a leaf of sage, very like Cheselden's lithotome and for the same object. He divided the skin and other tissues in the way pursued by Chaussier.

c. *Procedure of M. Dupuytren.*—The attempts of Chaussier and Beclard remaining unheeded, it is to M. Dupuytren, in fact, that transverse lithotomy owes all its importance. In its performance this surgeon employs two particular instruments, the one is a bistoury with a solid handle, a kind of scalpel cutting on both edges for an extent of some lines near its point; the other is a double lithotome, the idea of which must have been suggested by an expression of Franco's, and which is a very exact representation of the incisory forceps of Tagault, delineated in page 366 of Joubert's addenda to Guy's work, printed in 1649, which had been mentioned by Fleurant in speaking of operations on the female, and of which Beclard and Chaussier had equally thought, but which it was reserved for M. Dupuytren to render as simple as possible and to bring into general use.

According to Sabatier, its sheath is concave on one of its surfaces, instead of its edge, as in Come's instrument. Its two blades are also concave, so that they may, by their separation, represent a curve, and so avoid the extremity of the rectum. Its handle is conical, instead of being simply square, and by means of a screw may be made to approach or separate for as many lines as are wished from the union of the sheath with the blades, and give to the whole a determinate degree of width of opening. M. Amussat thinking this too complicated still, has proposed to substitute for it a kind of scissors which cut on their edges when they are opened, and which are a blunt instrument when closed; but these scissors do not fulfill every purpose proposed by the use of the double lithotome. In fact, a simple transverse incision is not what the surgeon seeks to effect; it must also be oblique backwards and outwards on either side, so as at once to include the two largest radii of the prostate. M. Dupuytren, who early discovered this fact, found all that could be asked for in this particular in the modifications effected in his original instrument by Dr. La Serre, and that ingenious cutler M. Charriere particularly. From the description given in the essay of M. Bouille, the instrument of M. Charriere is, I find, so constructed that pressure on its only bascule which is situated on the handle, causes the two blades to leave their sheath immediately, and describe by their separation a curved line exactly similar to the outer incision, so that they divide the prostate obliquely backwards towards the ischial side, encircling the exterior surface of the rectum to the right and to the left. Lastly, instead of the usual staff, M. Dupuytren has contrived one which is swelled at the seat of its greatest convexity, the better to distend the urethra, and whose groove is more shallow towards the point than the centre. The patient is to be placed as if for any other species of operation for stone. The surgeon seated in front of the perineum, makes tense the integuments with his left hand. With his right hand, holding the scalpel, he

makes a semilunar incision; commences it near the right ischium; passes six lines in front of the anus, and ends it within the left ischium, so that its horns may fall towards the centre of the space which separates the anus right and left from the tuberosities of the ischia. Thus he successively divides the several layers which occur, pressing most strongly on the median line until he reaches the membranous portion of the urethra, which he cuts longitudinally, lays aside the scalpel, takes the lithotome, whose handle has previously been set at a proper degree of separation, rests its point upon the staff, its concavity looking upwards, and pushes it on into the bladder, as is done when brother Come's instrument is used. Before it is opened, it is made to describe a half circle, in order that its concavity from looking upwards may become lowermost and look towards the rectum. Then it is opened and withdrawn in the direction of the external wound, the operator having seized it with his left thumb and forefinger a little beyond the handle, whilst with his right he keeps it steadily open to divide the prostate from within outwards as well as the soft parts which the scalpel had not encountered. Undoubtedly the scalpel may perfectly well be substituted for the common bistoury in this operation; the lithotome of frere Come, drawn from left to right, will cut the same parts; the double cutting edged gorget used by Dr. Physick as early as 1804, which Sir A. Cooper sometimes employs, and which was proposed by Beciard, is very proper too for effecting this double incision. In fact, the mere probe-pointed straight ordinary bistoury even, may be used instead of any one of these instruments for the division of the prostate. But it is impossible to refuse to the double lithotome, the immense advantages of completing the operation at a single stroke; of stretching the parts more certainly whilst it divides them; of making a wound of greater regularity; and above all of giving it a true curve, and not merely making a V shaped incision, which is all that can be reasonably expected from the use of a bistoury or any other lithotome. Gorgets have the same disadvantages here as every where else: that of a tendency to detach parts and crowd them back towards the bladder during the incision, which thereby becomes uneven and unequal in dimension. Reasoning at once detects the value of this procedure. If each blade of the lithotome is separated only four lines, a wound is inflicted evident at least eight lines long; ten lines long if the calibre of the urethra be included. Now, as every oblique posterior radius of the prostate is nearly ten lines in diameter, it is clear that an extent of twenty lines is thus afforded to the wound. Again, if the incision is a true curve, any traction made on it to straighten it will lengthen it still more; the posterior portion of the prostate pressed back along with the rectum whilst we are seeking to draw forth the stone, easily becomes a second curve parallel to the first, to such a degree that a calculus twenty to twenty-four lines in thickness, and five or six inches in circumference, might strictly speaking pass through this aperture and tear nothing in its passage.

In this respect, no species of perineal cutting for the stone, can at all compare with the transverse method. It threatens the intestine only when it is enormously distended on either side of the bas-fond of the bladder, because it cut the tissues outwardly and a little backwards; and even then only when it is necessary to give the lithotome a very considerable width of opening. The pudic artery is equally sheltered from injury; so also is the super-

ficial artery whenever it occupies its normal situation. The transverse artery can be but seldom reached, for the most advanced point of the incision must be situated behind the bulb of the urethra, in which it is seen principally to distribute itself. The only branches which could be divided are the posterior twigs of this latter vessel, when they are unusually large about the anus, and also the anterior divisions of the hemorrhoidal. The first incision falling upon the membranous portion of the urethra, and the two blades of the instrument being obliged first to extend themselves outwardly, the verumontanum and ejaculatory ducts are necessarily out of the reach of danger.

Nevertheless, it must not be forgotten, that in some persons the lower dilatation of the rectum is continued on as far as beneath the prostate; hence, if the cut be made too near the anus, we might easily pierce this gut in the first stage of the operation, as is said once to have happened. A danger which reasoning might have suggested is that of urinary fistula. It would at first sight appear that a wound so extensive in the posterior and inferior wall of the urethra would be but little disposed to adhesion, immediate or secondary. Experience, the only judge competent to decide upon such subjects has not confirmed the fears thus entertained. Its tenor has, on the contrary, been to show that as a general rule the urine assumes its natural course sooner after the bilateral procedure, than after any other. It would appear also that this method of operation has the advantage of being seldom followed by infiltration or suppuration in the thickness of the perineum; which may be explained by the remark, that the incision on either side extends beyond the pelvic aponeurosis; that it cuts but very little either of the origins of the superficial or horizontal aponeurosis; and that it is confined to the division of the internal layer of the ischio-rectal aponeurosis.

Thus far, twenty-six cases operated on by this method, are counted at the Hotel Dieu, and not one has died; and of a total of seventy mentioned by M. Dupuytren six only have perished. If even, as regards accidents it be no better than any other method, it must at least be admitted to be quite as good. To derive from it every possible advantage, it appears to me that the incision ought to fall upon the base of the uretro-anal triangle, so as to spare both the bulb and the anus; then to come down upon the posterior part of the membranous portion of the urethra, a little in advance of the prostate, having cut through integuments—subcutaneous layer—the intercrossing fibres of the sphincter ani, of the bulbo cavernosus, and transversus perinei muscles, and of the aponeuroses to the point at which they are lost in one another. The horns of the incision also should be so far extended in the direction of the ischio-rectal excavations, as to oppose no obstacle to the escape of fluids outwardly. If bilateral cutting did not allow of as rapid a cicatrization of the wound, as the incision on one side only of the prostate, the operation should then certainly, as Beclard thought, and as Scarpa proposes in his letter to M. Olivier, be a reserved method, useful only in cases where the stone is of great bulk; but since this is not at all the case, and the contrary happens, I see nothing to prevent it from becoming a method of general adoption.

Procedure of M. Senn.—M. Senn, a surgeon of Geneva, who studied for a long while in the Parisian hospitals, endeavored to prove, in his thesis, that instead of operating with a double lithotome it is better at first only to divide one of the oblique radii of the prostate, and that if then the stone

be too large the gland should again be cut transversely to the right at a second stroke with a straight probe-pointed bistoury. Proceeding upon geometrical data, he asserts that the triangular portion, thus cut at the expense of the urethra and its surrounding gland, which has its base backwards and to the right side, creates when distented or pushed towards the rectum in extracting the calculus, a larger orifice than the procedure of M. Dupuytren affords. M. Senn's method is different from Dr. Thompson's, advised by him in cases of large stones, in that one of the incisions is to the left, and another to the right; whereas in that of the English surgeon, one was made up and the other down on the same side. To me it is objectionable as being longer, and not altogether as certain as cutting by the double sheathed lithotome, and possessing no real advantage over the latter. It had been established as a principle by M. Martineau of Norwich, and it had also been advised by Louis himself, always to introduce the finger into the wound, when any difficulty in withdrawing the stone is experienced, with a view to detect the seat of resistance, and to enlarge the incision with a bistoury, either backwards, upwards, or outwardly, as Saucerotte did so successfully; whence it follows, that by some one or other procedure of the lateralized cutting, of oblique or transversal cutting modified by Louis, MM. Martineau, Boyer, Thomson, Dupuytren, and Senn, every radius of the prostate gland has been divided. From this circumstance arose a new method of performing lithotomy.

5. *Quadrilateral Cutting.*—In the year 1825, M. Vidal Cassis, who says that he had been engaged in researches in the hospital at Marseilles, feeling the necessity of not exceeding the limits of the prostate in enlarging the entrance of the urethra, and still the want of as large an opening as possible, was induced to propose in a thesis to incise this organ in its four principal radii, viz. backwards and to the left—backwards and to the right—and obliquely forward on two sides. This quadruple incision could be made, according to M. Vidal, at one stroke of a four blade lithotome, yet he prefers using a simple bistoury, carried successively in the four directions. The reason of this difference is, that if it be a small calculus only, it is optional with the surgeon to cut it only by one, or two, or three sides. His method has been pursued at the Hospital at Aix, by M. Goyrand, who speaks very favorably of his trials of it. I have myself had occasion to practice it upon a patient in whom there was a stone of two inches and a quarter in its largest diameter. The man was sixty nine years of age, and worn out with long continued suffering. I operated in the manner of frere Come; and it was not until I ascertained the impossibility of extracting the calculus without lacerating the parts, that I had recourse to that of M. Vidal, modifying it however in this way; that I might not be obliged to let go the stone, an assistant took charge of the forceps which held it, and raised them up a little on the left side. With a straight bistoury, carried in on my forefinger, I was able to incise the right posterior radius of the prostate, and then did the same to its transverse radius a little above. The operation completely succeeded, and the health of my patient was afterwards perfectly re-established. Pursuing this idea, each incision may extend only two or three lines, and yet together give an opening gained of nearly one inch. If they be made to extend to four or five lines, we see at once that an orifice of fifteen or twenty lines results; and thus a passage may be made for the largest calculi, without in-

curring the slightest risk of transgressing beyond the prostatic bounds or of wounding the rectum, or any of the arteries of the perineum. If bilateral cutting prove insufficient, or any fears are entertained about doing it, the idea of M. Vidal offers us then a resource which ought not to be despised. Supposing it to be at once decided on to operate by it, there would, in my opinion, be found an advantage in using the four bladed lithotome constructed by M. Colombat, rather than in making successively four incisions with a bistoury of the common kind, for the very same reasons which make the double lithotome preferable, in the simple bitransversal cutting. Besides which, it is necessary to recollect that M. Vidal incises the prostate in the direction of its oblique radii, and not from before backwards or transversely, as is erroneously stated by the recent editors of the works of Sabatier.

§ 3. *Recapitulation of the Method of Operation in different Species of Perineal Cutting.*

The Apparatus.—The surgeon before he begins the operation, is to arrange such instruments, &c. as may be necessary during its progress, according to the procedure on which he has determined. These thing are, 1st, staffs, sounds, and catheters of silver or gumelastic, in case of need; 2d, a common straight, a convex, and a curved Pott's bistoury, a straight probe-pointed bistoury, one or more cutting gorgets, and if it be intended to make use of it, one of the lithotome knives, previously mentioned; 3d, brother Come's sheathed lithotome opened for children to No. 5 or No. 7, to No. 9 or 11, seldom to 13 or 15, for adults; 4th, the probe-pointed scoop (*tige a curette*), having a crista on its plane surface; 5th, a simple gorget; 6th, straight and curved forceps, of various sizes; 7th, long polypus, dissecting and dressing forceps, straight and curved scissors; 8th, a needle fitted to a handle, either that of Petit or of Deschamps, and some common armed suture needles; 9th, a plain canula of silver or of gumelastic, another fitted with a sheath (*chemise*). Pledgets of lint fastened in their centres by loops of strong and well waxed thread; 10th, fresh lint, balls of it, bandages, compresses, lacs or lithotomy fillets, water, sponges, some styptic liquor, a strong syringe, and lastly, several wax candles, if the natural light be apparently not powerful enough for all purposes.

Of the Staff.—Amid all these objects, one or two, for example the staff and the forceps, require a particular choice to be exercised in their selection. *Cæteris paribus*, it is better to have the staff very large than too small. The larger it is the better it distends the urethra, the more easily is it felt at the bottom of the perineum, the better it conducts other instruments, and it renders the patient less liable to be wounded. The groove is to be at once wide and deep, otherwise it would be difficult for the finger to detect it through the thickness of the urethra, nor would the lithotome receive a suitable direction. After this, it matters but little whether it be semilunar in its transverse section as they used to be made, triangular as advised by English surgeons generally, or square as M. Dupuytren recommends. The cul-de-sac in which it ends being at best of but doubtful utility, and perhaps liable to impede the motion of the point of the lithotome, had better taper off insensibly, to preserve the rounded and blunt form of the staff. If the groove

were to be extended as far as to the point of the staff, it would be advantageous only when the staff was held stationary and not raised up towards the pubis before the division of the prostate, because then the point of the bistoury used is more firmly kept in it. The curve of this instrument need neither be carried all the way to its point; but this point, unless we wish to see it retreat into the urethra, when we suppose it still in the bladder, must extend at least an inch or two beyond the axis of the handle. It is scarcely necessary to add, that the shape of the flat piece on the handle is a matter of taste entirely, and that it is rendered in nowise more convenient by substituting rings after the manner of Ponteau's, nor by attaching a wooden handle to the stem, as in that of Lecat.

Of the Forceps.—The forceps in ancient use, which were jointed like scissors very near the grasp, had a double inconvenience, that of opening wider in the wound than in the bladder, and of seizing the stone badly. The mere removal of the rings upon the outer sides of the handle did not suffice to remedy this defect, to effect which the handles were so arranged as to cross one another more or less within, and thus before they extend beyond the axis of the instrument without, they allow of the forceps opening considerably. That variety which has the two blades parallel when separated, and not divergent, and which has a lateral articulation, such as is to be obtained at M. Charriere's, has an additional advantage of letting go its hold less easily, and of better adapting itself to the form of the stone.

Position of the Patient and the Assistants.—A common bed is too large, too yielding, and generally too low, to be substituted in private practice for the operating table which is used in public institutions. However, I myself, am not fond of those mechanical contrivances which some are in the habit of having conveyed to their patient's houses. Therefore, M. Heurteloup's table, and that of MM. Tanchou, Rigal, and others, however ingenious they may be, seem to me to be no more indispensable than M. Rouget's bed, or the lithotomy table of the ancients. A commode, a common table, or a cot, firmly fixed and properly covered, are much less alarming, and always quite sufficient for a surgeon who has no desire to acquire notoriety by the use of any particular means. What is wanted, is that the patient should lie on his back, have his head and chest flexed, or moderately raised, so as that his pelvis be not sunk in the mattress; that the perineum pass beyond its edge; and that the assistants may move easily around him. At the present day, the Celsian method of seating the patient doubled up on the knees of two strong persons, and then of binding him with ligatures passed under the armpits, roots of the thighs, over the hands and feet, as prescribed by mnemonists, is no longer thought of.

The list bandages, in a figure of 8 form, employed by Le Dran, are not necessary. When it is remembered that no species of confinement has ever been advised in operations for hernia or aneurysm, we see no reason why in stone there can be urgent need of any unless the patients are children or lunatics. I have so far dispensed with it, without ever having reason to repent doing so; although in a patient under my care at La Pitie, from whom in October, 1830, I removed an immense stone, the operation was as laborious a one as possible. If, nevertheless, prudence or necessity induce one to prefer it, we require a flannel bandage, or failing in this, a strip of flexible

linen of three fingers' breadth and two or three yards long. With this bandage, doubled where the loup is, we make a running knot, which is carried over and tightened on the patient's wrist, who then takes his heel into his hand, leaving the thumb on the fibular side, the fingers below, and the radial edge of the hand forwards. The two ends of the bandage are then taken by the surgeon, who separates them, carries one inwards, the other outwards, crosses them over the ancle, carries them to the sole of the foot, brings them up, then backwards, and then lastly forwards, where he fastens them in a bow, being careful to leave the free extremity outwards. The foot and hand of each side thus confined are confided to two assistants, who stand on either hand, on the outer side of the limb, their backs turned a little towards the head of the bed, performing the same office exactly as if no ligatures were used. Whilst with the hand which is towards the pelvis each assistant seizes the corresponding knee to bring it from the axis of the body, he employs the other in grasping the foot by its inner edge and back, pronating it outwards; if he were to lay hold of it below, the patient might use this hand as a fulcrum to elevate his pelvis, which is particularly to be guarded against. This disposition to raise the pelvis, which is particularly noticed among children, joined to a rotatory motion from right to left, is so difficult of control, as to require the co-operation of a third assistant, who should be tall and strong if possible, and who is to stand on the left side. By the application of the palms of his hands on each crista of the ilia, with the thumb of each hand spread over in front from the anterior superior spinous process into the fold of the groin, he manages every movement by slight efforts of pressure, and in general with but little fatigue. A fourth assistant seated on the table or the bed watches over the action of the head, and closes the patient's eyes with a compress. A fifth stands to the right, opposite the side, to raise up the scrotum and support the staff. Lastly, a sixth is at hand to pass to the surgeon such instruments as he requires in the course of the operation.

Introduction, and Location of the Staff.—Before proceeding to the division of parts, the operator introduces the staff into the bladder, and does not permanently locate it until he has himself again recognized the presence of the stone, and pointed out its existence to some one or other of his assistants. It has long been an established rule to let the flat handle lean towards the right groin, so that its convexity shall bulge out the perineum more or less to the left of the median line, and obliquely backwards towards the ischium; but it is doubtful how far this rule is a good one, or any other force than that of long established routine, particularly when we mean to open the prostate with a gorget or the sheathed lithotome In fact, the inclination given the staff does not change the direction of the parietes of the urethra, as respects the axis of the canal. What matters it after all that the urethra be opened on the side or upon the median line, when we have only to do with its membranous portion, or to make a way for the entrance of other instruments? The only good reason which can be given for this practice is, that perhaps it affords greater facility for avoiding the bulb, by the crowding back to the left of that portion of the urethra which conceals this enlargement, and which consequently becomes no obstacle in the remainder of the operation. It is, therefore, nearly optional to place the catheter to the left, as is generally done, or on the median line, as is preferred by MM. Scarpa and Astley Cooper, even in performing

the lateralized operation. Instead of holding it ourselves with the left hand with a view to direct its movement better, and alter its position according to circumstances as many do, following the advice of Ponteau, it is usual among surgeons at the present day to entrust the staff when its situation is decided on to an intelligent assistant, who ought to be well acquainted with its mechanism and uses.

First Stage.—The surgeon standing up, or if the relative proportions of his height with that of the patient seem to require it with his right knee on the ground, or upon a stool if necessary to support it, armed with the bistoury he has selected in his right hand, first cuts through the integuments, which he makes tense with the thumb and fingers of the other hand, not heeding the scrotum which is gently upheld by the assistant who holds the staff with the right hand. This incision begins on the left side of the raphe about an inch in advance of the anus, is to stretch obliquely backward, and end midway in the space which separates the tuberosity of the ischium from the opening of the rectum, its length being about four inches. Made nearer the scrotum it exposes to infiltration, and no object is gained. It is useless to prolong it towards the sacro-sciatic ligament. Were it any shorter it might interfere with the extraction of the stone, and would not favor sufficiently the escape of urine. Nearer to the median line it would frequently fall upon the rectum; and if it were practised as Roux did, very near the ischio-pubic ramus, it would not preserve its parallelism with that in the deeper seated parts.

The bistoury again applied to its upper angle, divides the subcutaneous layer, the posterior edge of the transverse muscle, and successively all the other layers which intervene between the skin and urethra, carefully bearing most firmly on the centre part, and not on the two ends of the solution of continuity.

Rather than to continue this manipulation until the instrument is bare in the urethra, it is better to feel through the yet undivided tissues for the grove in it with the fore finger, and place the right edge of the fissure between the nail and pulp of the finger, the radial edge of which is looking downwards. The surgeon sliding the point of the bistoury which he has not laid aside, like a pen upon the nail which is kept motionless, pierces the lower wall of the urethra, a little in advance of the summit of the prostate, and strikes upon the fissure in the staff. The forefinger which guides it is then raised on the back of the bistoury, pushes its point towards the gland for an extent of three or four lines, whilst the operator with his other hand raises the handle and continues to press it against the groove in which it is engaged. Should it slip out, the rectum runs the risk of being pierced. Uretro-cutaneous fistula originate from this cause, of which MM. Dupuytren and Begin, cite an instance, and of which I know myself another. The forefinger now resumes its steady position at the edge of the staff, and then the right hand draws out the knife, whilst at the same time it depresses its shoulder so as to divide yet more largely the layers nearest the urethra.

Second Stage.—The period for introducing the lithotome, which ever it may be, has now arrived. If it be that of brother Come, the operator takes hold of its handle, not touching its bascule, strikes its beak over his nail into the opening in the urethra, so as to strike perpendicularly on the groove in the staff, moves it along it upwards and downwards to be sure of its having en-

tered, and when he perceives the contact of the two metallic bodies, he rises, if he has been kneeling, takes his fore-finger out of the wound, takes the staff into his own hands, lowers its flat handle and tilts up the point with his left hand, whilst with his right he slides the summit of the lithotome along the groove into the bladder, a gush of urine from which immediately denotes its having entered.

The same precautions are called for by the use of a gorget; nor does prudence require less when a tongued or probe-pointed bistoury is used: small solid handled knives, straight or convex are employed. If the visceral end of the staff were not tilted towards the symphysis pubis to make way for these instruments, they would equally cut the prostate it is true; but then, either their point or their edge will almost inevitably strike the trigonal vesical space so as frequently to penetrate it from side to side. By following its groove, on the contrary, owing to this elevating movement, they bring it into correspondence with the vertical axis of the bladder, and penetrate with impunity as deep as may be required, so that on withdrawing them we may give the incision all necessary extension.

The staff having performed its office is now withdrawn. The hand in which the handle of the lithotome is held, slips some fingers below its bascule and opens it; the other hand takes hold of its back on the level of the articulation of the sheath with its blade, the thumb on the right side, the forefinger semiflexed on the left side, its radial edge being directed towards the pubis. Its cutting edge looking in the direction of the outer incision, or in any other way if it be preferred, both hands are to unite their efforts to withdraw it. It is the part of the right hand to prevent the sheath from leaving, as it is being withdrawn, that point on the arch of the pubis against which its dorsal or concave edge had at first been applied.

The right hand, which has to draw it forth, has two dangers to avoid. By raising the wrist too high the incision at its base would be deeper than at the point of the prostate; too considerable a depression of it would not only produce the contrary result, but expose the rectum to the danger of being wounded. If it were not kept firmly pressed against the pubic arch there would be no fixed point, and the dimensions of the wound would vary according as the blade should be brought down with greater or less force: one of the inconveniences attending the gorget and the bistoury.

Whatever be the instrument with which this separation of parts is made, we should find that by saving the tissues situated immediately below the prostate, as advised by Morand, no other advantage would be gained than more certainly avoiding the rectum, for it is not here that the transverse artery of the perineum is situated; but a dangerous obstacle would result to the passage of the urine.

As on the other hand the intestine is sufficiently well protected by the obliquity of the incision, it is unnecessary to follow this advice. The more the axis of the wound approaches the perpendicular, *i. e.* the axis of the body, the greater is the chance that neither abscess nor infiltration will occur. On the whole, the deep incision being intended to enlarge the entrance of the urethra as much as possible without going beyond the limits of the prostate, ought to bear upon the greatest radius of this gland, not only from the centre to the circumference but also from before backward, and so that the circle

of its base only be respected. This is a problem to be solved in the lateralized operation. Now, the smallest reflection shows us that to do this there can be no advantage in cutting the membranous portion of the urethra; and that it is alone necessary to open this duct near to the summit of the prostate, and consequently back of the horizontal aponeurosis of the perineum. For the same reason, it will appear how perfectly useless it is to continue the incision of the other tissues in front towards the pubis, because its only object is to make a passage sufficiently large for the stone; and that for the sequelæ of the operation, the escape of urine, it is particularly necessary that its enlargement should be made in a backward direction.

Third Stage.—The lithotome having now become useless, is now passed to the assistant, and its place instantly taken by the left forefinger, which being introduced from below upwards, and from before backwards, serves to ascertain, 1st, the internal condition of the organ; 2d, the position, sometimes the size, the form, and even the number of stone's which it contains; 3d, the dimensions of the wound. Care must be taken that the finger in its passage does not detach either the intestine nor prostate, by getting by mistake between these parts. Before it is withdrawn the probe-pointed bistoury is conducted in upon it to enlarge the wound if too narrow, either prostatic or perineal, in one direction or in the other; after which it serves to conduct the probe-pointed scoop, the gorget, or else the forceps. To do this, it had better be placed with the nail turned backwards in the inferior than in the superior angle of the wound; for the reason that the instruments it is to direct, have a greater liability of escaping backwards between the tissues than they have forwards. The scoop being longer and thinner than the gorget, pervades the vesical cavity better, and reaches the stone more easily wherever it be situated; but is afterwards rather less convenient as a guide to the forceps. In a great majority of cases, however, both may be dispensed with; and the forceps be passed in immediately upon the finger. As soon as their duty as exploring agents is finished, they are brought back instead of the finger; so as to be able to depress the posterior angle of the wound with whichever one we employ. With the right hand now at liberty, the operator presents the forceps above, one grasp or blade to the left and one to the right, and slipping them in on the gorget,* or embracing the crista of the scoop between their half open edges, pushes them as he had done for the finger, penetrates into the bladder in this way, and at the same instant disengages the conducting instrument. Before we think of seizing the calculus, we try again to touch it by various motions of the instrument. All this makes the latter stage of the operation sometimes the longest of any and the most difficult, though it is generally the simplest and speediest. The surgeon then opens the forceps with both hands; the forefinger and thumb of each acting on the corresponding ring. When the blades are far enough apart, he turns it suddenly round on its axis, so that it describes the quarter of a circle from right to left; so that one spoon becomes quickly the lower, the other the upper; the lower one raking in a measure the wall of the bladder, and slipping beneath the stone. If this movement does not succeed the first time, it is repeated,

* This gorget, called "simple," is not a cutting instrument, but merely a grooved body attached to a handle, of varying size. Its use is to conduct the forceps to the stone, and hence is called "gorgeret conducteur."

either in the same way or from left to right, or by elevating or depressing the wrist a little more. The stone when grasped, may separate the handles of the forceps more widely than it was at first supposed it would; this is owing to its being too near the joint, to its not being seized in its smallest diameter, or to an erroneous idea of its size. In the two former cases this is remedied by pushing forward the calculus with the scoop, or by moving it about until it presents by its thinnest part without letting go of it entirely. In the latter case there is no other resource than to cut away the frenum, if the prostatic opening does not appear large enough. It is better to let it go and seize it again, than to persevere in attempting to rectify its malposition in the grasp of the blades which hold it; understanding that if it be not a very large one all these precautions will be found unneeded. If the stone should be a flat one, and much longer in one direction than in the other, although seized by its smallest diameter, it might need relaxing, and then to be seized again if it came crosswise to the wound. The same thing will also happen if it be somewhat elongated, cylindrical, or shaped like a girkin. These peculiarities are pointed out to exist, by the insurmountable resistance which is all of a sudden offered at the moment that the forceps seems entirely to be leaving the bladder.

The forceps, even though they have never been opened, having an interval between their blades that they may not pinch the inner membrane of the organ, may have received the stone if a small flat one between them, and may contain it in one of their spoons unknown to the operator. This may be suspected, if having touched or endeavored to lay hold of it we no longer feel it any more. The forceps is in this case to be withdrawn to examine as to the fact. Besides, it is not very uncommon to see small stones escape with the stream of urine, or stop for a while in the trajet of the wound, so that their existence is rendered doubtful.

Let us suppose now that the stone is fairly seized. The forceps being again placed horizontally, the surgeon takes hold of the rings on the handle with his right hand, fastens them with his left hand turned supine, as near the grasp as possible; the fingers being below, the thumb above. He then begins his traction, after being well satisfied that the stone is free, and the only thing grasped by the forceps. To do this he presses it down with the thumb of one hand, that it may press principally against the posterior angle of the wound, whilst the other hand performs the necessary tractive efforts. These are made from right to left above downwards, rather than directly forwards, being careful to make them follow the direction of the axis of the pelvis as in extracting the head of a fœtus.

Should the straight forceps pass constantly over the stone so as not to be able to enclose it in its spoons; in a word, if the stone escapes, owing to its having swerved from its position, being too low or situated in too deep an excavation, curved forceps are indicated. They are introduced like the others, and their cavity is turned towards the direction of the stone to seize it; they are drawn out in a contrary one for its extraction. That species of forceps resembling the obstetrical instrument invented by F. Come, are indispensable only for very large stones which are accurately encircled by the bladder. The branches are introduced separately, sliding them between

the parietes of the organ and the foreign body; they are then locked, absolutely as in manipulating with midwifery forceps.

The calculus being brought out, it is not to be laid aside until its appearance has been inspected. If it is rounded, of an elliptical, oval, elongated, but destitute of angles and facets, we are entitled to believe that no others exist in the bladder. Calculi covered with projecting roughnesses induce the like belief. Those which present us with surfaces as smooth as if they had been chiseled off, separated by edges or by distinct angles; which offer every indication of being fragments or broken stones, of course lead us to suspect the reverse. This mere glance however gives mere presumption only, and does not permit us to dispense with other examination. We are therefore to carry in the scoop or the finger within the cavity of the organ, to know exactly how the case stands, and so as to withdraw every tolerably large sized piece of any foreign body. Some bladders, in fact, contain a very considerable number. That of a patient who had been cut three times contained three hundred at the time that M. Ribes made the examination of his body. Recently the journals have mentioned a patient from whom M. Roux extracted near a hundred; and in another M. Murat counted six hundred and seventy-eight. It is of vital importance that none of these calculi remain either in the bladder or in the trajet of the wound. As they are usually very small they may very easily lose themselves amongst the parts, and that unless the most scrupulous minuteness of observation be used the patient will run the risk of preserving about him the nucleus of stone after the operation. The size of the stone may also become a source of embarrassment. When they exceed two inches in their small diameter, it is often impossible to extract them, even by the recto-vesical cutting. In a case of this kind last year, M. Dupuytren performed the operation of lateral cutting, and slit up the anterior wall of the rectum. Divers instruments have been invented to break them into fragments in such a case. That of brother Come has two pyramidical teeth within the grasp, which is flat-filed. The stone-breaking forceps of Benj. Bell, are also denticulated, and a screw crosses the handles. M. Sirhenry's forceps for breaking the stone, by penetrating per urethram; the "pince a virgules" of Baron Heurteloup; the friction forceps of M. Rigaud; the "anse brise" of Jacobson; in a word, almost every forceps used in midwifery will accomplish the object. The latter instrument would possess the advantage of allowing of the perforation of the stone, if their ordinary construction did not permit us to break them, and should I think be preferred; but the stones which render such manipulation indispensable, are so large and difficult to embrace that it is generally thought preferable to proceed at once to the operation of hypogastric cutting, and extract them above the pubis. No one is now so fearful of seeing a stone when friable break beneath the forceps, as to employ Broomfield's quadruple forceps, the graduated ones of Lecat, the horsehair fillet of Huss, Home's circular development forceps, or the triple forceps with fenestra in the grasps made by Cluly, the cutler in Sheffield. If the thing occurs it is found more convenient to go successively in search of all the fragments with the same instrument, and wash away the fragments with emollient injections afterwards.

The state of fixedness of the stone has been at every period a source of more embarrassment with surgeons. Before we lose ourselves in useless efforts we should try with the forefinger to detect the nature of the difficulty which exists. If the foreign bodies seem to adhere by one surface only, probably some fungous growths and vegetations have sprung up between its roughnesses. In this case, the plan of Lapeyronie, followed by Marechal, Le Dran, M. Boyer, &c., which consists in methodically pulling at the stone with forceps when once it is seized, to tear it away; is the only one which will answer every time that the finger or scoop fail to shake it from its attachments. If it is simultaneously encysted and adherent, rubbing away the cyst with a staff, advised by Littre, will be of very little service. Scarcely better would pounding it with forceps, which he also advises, prove to be; laceration here is equally the only remedy. When simply stopped by a frenum, or contained in a cyst more or less largely open, and not adherent, a cutting instrument should not always be forbidden; Garengeot, Le Blanc, and Desault have used it with success. A straight, or curved probe-pointed bistoury, surrounded with a strap of linen round its edge, to within five or six lines of the button, should be very cautiously carried to the free border of the cyst; then introduced flatwise between the stone and the cyst, so that as its blade is withdrawn it may cut the adventitious sac from top to bottom to a suitable extent, almost as if we were relieving the stricture in a hernia. Nothing prevents this operation from being performed on other points of the frenum, if the first does not suffice, or it appears too dangerous to extend it far enough.

The tonsil kiotome, or frenotome, used by Desault, certainly is not equal to the bistoury of Pott, and does not deserve adoption. The common straight bistoury employed by Garengeot, offers two inconveniences; 1st, its point incessantly threatens to cut the wall of the bladder; 2d, it neither slides, nor can be introduced as easily between the cyst and the surface of the stone, as the bistoury which is probe-pointed. The surgeon should however remember, that a frenum formed by simple partial contraction of the urinary pouch, and that abnormal sacs existing with it, instead of projecting inwardly will not admit of such incisions at all, or only with the utmost reserve; for as they then bear on the inner surface of the bladder itself, this would seldom fail to injure the peritoneum.

An exception should still be made in favor of calculi fastened by one end within the ureter. The orifice of this canal, which crosses the thickness of the bas-fond of the bladder very obliquely, might in fact be incised separately for an extent of several lines without any danger.

It is better to return to force, shaking and tractions in various directions, if a stone of a gourd-shape for instance be retained by one end in the ureter or in a secondary cavity of the bladder, and only have recourse to incision when in despair of succeeding in any other way.

Cutting at Two separate Times.—The difficulty of seizing, or extracting the stone, the dread of exhausting the patient by fatigue from long searches, have led to this idea of practising the operation at distinct intervals; that is to say, at one to confine oneself to merely opening the bladder; to put off the other till the extraction of the stone. The same idea had been set forth by the Arabs, for which Albucasis says, that if the hemorrhage comes on, the

surgeon is to touch the wound with vitriol and wait. Franco, who re-established it, waited for three or four days. Maret, of Dyon, nevertheless, is the first who endeavored to render it general. Since then it has received the support of Camper, of T. Haaf, who returned to the search after a lapse of eight days, and more lately of M. Guerin of Bordeaux. It is doubtless to be expected after its adoption, that at least the foreign body will approach the passage made for it and be reached with less difficulty; and even, that it will escape by the wound, and fall into the dressings. But in spite of these advantages, there is to be endured the restlessness of the patient, the ceaseless irritation of the stone, the acute pain produced by the passage of the forceps through a wound more or less inflamed; in a word, two operations instead of one. Consequently modern practitioners have rejected this form of operation, and never, unless it is impossible for them to do otherwise, leave a stone in the bladder after having once divided the soft parts.

Injections.—For fear that some gravelly fragments may still remain behind in the bladder, most surgeons are in the habit of washing it out by large injections of warm water or emollient decoctions. When carefully effected, injections can never do harm. Nor do we see how they can be dispensed with, for they have the undoubted advantage of bringing with them clots of blood, flocculi of mucus, as well as fragments of stone, which often evade the most attentive scrutiny. To exhibit them we require a large syringe, a common glyster syringe, which will contain a quart or more of fluid. With less the gush of the injection would not be forcible enough to expel the matters which we are anxious to expel. Not to wound the organ we may use a syphon ending like the top of a watering pot, either of tin or of gumelastic. However, with a little dexterity and an unrefractory patient the common pipe exposes him to no risk. After the first injection a second, and then a third, are made so as to be yet more sure of detecting heterogeneous matters. We are then to wipe off the patient with a sponge and some warm water, and remove the ligatures and other fetters which the operation may have rendered necessary. The patient is then placed in bed upon his back, his head and chest moderately elevated, the lower limbs close together, semiflexed, and kept so by a sheet folded cylindrically and placed under the hams. Tying the legs and thighs of the patient to prevent them from separating, as was done only as late as the last century, is a useless proceeding. Even the supine position need not be permanently maintained. The patient must be allowed to lean on either side, and confine himself to his back only so long as it is not inconvenient or attended with fatigue.

The Canula in the Wound.—The practice of placing a catheter in the bladder, the more quickly to re-establish the natural route of the urine, has long been discontinued. The same is nearly the case with the canula, which many operators once thought it necessary to leave in the wound for a certain number of days after the operation, and which was intended to prevent infiltrations by conducting out the effused fluids. This tube, which some practitioners are still in the habit of using under certain particular circumstances, irritates the wound, the neck of the bladder, and also its lining membrane. It is a foreign body thwarting the restorative efforts of the organization, a greater or less annoyance to the patient, and which alone may give rise to fearful symptoms. I once saw it used in an old man

eighty-four years of age who was soon attacked with adynamic symptoms, and who died at the end of eleven days. The whole length of the wound was covered with a grayish concretion; pus was poured out round about it, and traces of purulent inflammation were discernible even within the pelvis. Thus it is an instrument more hurtful than useful; and if it should ever be an object to guard against approximation of the edges of the incision, it would be better to place a tent or pledget of lint between them.

Untoward Occurrences.—The first accident to be feared in lateralized cutting in general perineal lithotomy is hemorrhage. This may occur under three circumstances; during the division of the tissues, in the four and twenty hours subsequent to the operation, and after a lapse of several days.

In the first case it must be owing to lesion of the arteria superficialis, the arteria transversa, the hemorrhoidal, or trunk of the pudic artery of the prostatic plexus of veins, or else of some anomalous artery. It comes from the superficial when the blood springs from the upper angle of the wound and subcutaneous layer; from the transverse on the contrary if it can be stopped by pressure with the finger some way down on the outer lip of the wound opposite the bulb and membranous portion. It is caused by the hemorrhoidal if the stream comes from the lower angle of the solution of continuity. It is likewise backward and outwards when the pudic has been cut, but its source will be perceived at a great depth. That bleeding which results from dividing a vein, or which is caused by the section of some artery around the prostate being more deep-seated than any other, will in the former event be known by the color of the blood, and in the second by the circumstance that no pressure on any part of the perineal wound with the finger will arrest it even for a moment. When the blood does not flow per saltem, and is not in sufficient abundance to weaken the patient much, no obstacle should be offered to it. It is frequently a salutary loss, and capable of warding off serious evils. On the other hand, if threatening to be abundant, to be lasting, when the patient is already much weakened, or very aged, it is proper to check it at once. When it can be applied, ligature is the best and most simple means for the purpose. When the divided trunk can be seen in the wound it is to be seized with a pair of dissecting forceps, or if not sufficiently isolated with a tenaculum and a thread immediately passed around it. If it were the pudic we had to tie, and its extremity difficult to seize, we should, I think, imitate Dr. Physick, who cut it in his first operation for stone, and pass between it and the ischio-pubic ramus a double thread by the assistance of a curved needle in the handle contrived by J. L. Petit. This needle should be buried in the interior of the wound, would pass on the outerside of the artery behind its division to re-enter the solution of continuity, where the thread is to be disengaged from its point so that it may be withdrawn, and immediately be knotted over the tissues. I do not think that the advice given by Mr. Travers of carrying in such a case a ligature round the vessel as it passes between the sciatic ligaments can ever be thought of. Besides, this wound is so uncommon, so difficult to inflict, unless we depart widely from the rules of scientific surgery, that the means of guarding against the danger from it are of minor importance. It is also probable that persons have been frequently misled as to its existence by bleeding from anomalous branches, or from some of its secondary branches rather larger than common.

Supposing it were easy to isolate and seize the vessel, but that it was too high up for us to surround it with a ligature easily, we should not hesitate to twist it by means of the forceps which have hold of it. Lastly, if neither torsion nor ligature can be applied, or entirely fail to arrest the hemorrhage, several other means are to be tried. The large canula, so arranged as to fill and press upon all the extent of the wound, in use not half a century ago, was inconvenient from compressing more strongly towards the skin than the prostate, and frequently causing effusion of fluids into the bladder. It appears that M. Boyer has frequently advantageously used a strong roll of lint carried within the bladder itself and fastened by a string, the two ends of which are then knotted to another roll which is passed down as deeply as possible on the same side as the urethra; but the little contrivance of M. Dupuytren is here evidently the preferable one. It consists of a tube open at top and on the sides, around which is attached a sort of shirt made of fine linen. It is introduced in beyond the neck, and then we are to slip between it and its linen covering some lint with a pair of dressing forceps until the wound is quite full, so as to compress all the circumference suitably, rather more strongly towards the bottom than near the skin. All this being retained by a T bandage, offers no impediment to the flow of urine, and moreover allows us to increase or diminish the pressure in one or another direction as may be requisite. In two or three days the surgeon gradually takes out the lint, and soon afterwards the rest of the apparatus.

If the bleeding does not show itself for some hours, it is seldom a source of so much uneasiness as to require instrumental attention. The blood which now appears had not appeared at an earlier period, not because the contact of the air had for a moment constricted the vessels, nor because of any spasms of these canals, but because the general circulation usually very slow in the patient when stretched on a bed of pain, experiences a lively reaction, a renewal of power in its impulsive efforts; and therefore it is that the evil often cures itself, and that this hemorrhage is easily suspended by the application of cold or revulsives, which tend to draw the fluids into another direction. In such a case we might begin by applying cold to the hypogastrium, the upper part of the thighs and perineum, and even by injecting it into the wound. If there be fever and a hard pulse, a small bleeding from the arm is evidently indicated. In a contrary condition of system, manuluvia of mustard, dry cupping, scarifying between the shoulders, mustard plasters to the same regions should be tried before tamponning or the ligature, unless the hemorrhage was profuse in the extreme.

When it does not appear for some days we may be pretty certain that it results from no opening of an artery, but from pure exhalation either from the wound or vesical cavity. To account for it on a contrary opinion we must suppose the separation of some eschar from the vesical parietes, or, as in fact is sometimes seen, general debility, decided dissolution of the fluids which has softened all the sanguineous clots, and broken down every barrier opposed to the exit of the separative fluid. It is therefore to be considered as the most dangerous. It admits of no other treatment than that advised for the preceding ones.

Wounds of the Intestine.—If the rectum is wounded in the first stage of the operation, or in any way before the bistoury has cut the neck of the blad-

der, the wound is always found beneath the prostate gland. It most frequently occurs in withdrawing the lithotome, and then the perforation has its seat at a more elevated point above the sphincter. Frequently it is not first perceived. It may even happen that at first the perforation was not complete, but that the wall of the rectum, previously much thinned by the cutting instrument, is bruised, and irritated during the extraction of the stone, and that the fall of the slough completes the misfortune. This at least seemed to be the case with a patient whom I saw operated on at the hospital St. Louis, in 1822. In the first of these events, *i. e.* when it is known directly, either by the escape of gas, or the passage of fecal matters or urine, that the rectum is wounded, and the division is extensive enough to induce the belief that it will end in fistula, the best way to prevent its occurrence is to slit the end of the perineum and of the intestine to the anus. Contraction of the sphincter being no obstacle to the free passage of the matters, the wound generally heals up kindly, and almost as quickly as if nothing uncommon had happened.

In the second event—that is, when some days elapse, and there be or be not any loss of substance, vesico-rectal fistula is already formed, and it is not impossible that it may disappear spontaneously—we should wait the ordinary term of the cure, and afterwards treat it as if it had resulted from any other cause. Urethral fistulæ, properly so called, are now very rare, though still sometimes seen; but whether they extend directly outwards, or only communicate externally by the intervention of the anus, their treatment is the same as that of urinary fistula, which will be discussed in a separate article.

Paralysis of the Bladder.—Retention of urine, caused sometimes by clots of blood, swelling of the wound, inflammation of the cervix vesicæ, or of the prostate syncope, convulsions, incontinence of urine, inflammation of every sort which may show itself during or after cutting for stone, require no further treatment than that generally known and followed in the case of these diseases. The wound is a longer or shorter time in closing. The urine flows through it entirely for two, three, four, or five days; and then the patient, from time to time, experiences the inclination to void it. At length some drops pass through the urethra. More then comes through it, and ultimately it passes entirely by the natural outlet from the fifteenth to the thirtieth day. From that time, the perineal opening has entirely healed. However, it is not uncommon to find them follow other routes in their exit. In some they continue to escape by the wound for two, three, four, even five and six months, so that the wound may in reality be considered as a fistula. In others, again, the wound in the perineum closes directly, or in eight or twelve days. In America, Drs. Physick, Dorsey, and Copeland have each seen an example of this occurrence. Beclard has seen several, following the bilateral cutting. Few experienced operators have not seen cases, but few have mentioned so large a proportion as M. Clot d'Abou Zabel, either after lateralized cutting, or the median cutting of Vacca, of which he quotes eleven cases.

Art. 2.—Recto-vesical Operation for Stone (Posterior or inferior).

The pains which surgeons in all ages have taken to avoid wounding the intestinum rectum, in the performance of lithotomy, is of itself sufficient to

prove how very far they were from wishing to establish this method as a principle. It is accordingly but of late years that the idea has suggested itself to practitioners, and M. Sanson, who first ventured to promulgate it in 1816, found in this time-hallowed prejudice, one of the most powerful opponents to the adoption of his way of thinking. It is now found out, that the extraction of stones by the rectum is not an entirely new practice. M. Jourdan, amongst others, has noticed that Vegetius, a veterinary surgeon mentioned by Haller, had said in a work published a century before at Basle, "jubet per vulnus recti intestini et vesicæ aculeo lapidem ejicere." A mention made by frere Come, of a patient who had a recto-vesical fistula caused by stone, and who recovered after the foreign body was extracted through the gut, may also have served as the basis of M. Sanson's theory. The splinter taken out of the bladder by enlarging the fistula in the rectum by Camper, is a new proof which might have been made available. It is, moreover, very well known, that Desault at the Hotel Dieu very frequently cured recto-vesical fistulæ by cutting the sphincter ani through, so as to create a wound which should extend all the way to the perineum. It must be added that, according to the statements of Dr. Clot, recto-vesical cutting has been practised in Egypt from time immemorial; he has seen it performed by empirics who are very numerous in that country, and whose knowledge had been handed down from father to son like a family estate. However, as no one among us had established the procedure as a regular one, of going through the rectum in search of calculi in the bladder, M. Sanson deserves to be fairly considered as the inventor of "*recto-vesical*" cutting. His method, which was never much advocated in France, England, or Germany, was in Italy almost at once adopted by several surgeons of distinction, among others by Vacca, Barbantini, Farnese, Giorgi, Guidetti, Giuseppe, Lancisi, &c. The advantages ascribed to it by its inventor, are those of being more easy, less painful, of opening the bladder in the largest direction of the pelvic strait; of exposing no artery to be wounded, and of allowing of the extraction of the very largest calculi. But with us, the dread of being unable to close up the communication between the gut and the bladder after the cure, has weighed against every other probable advantage. Indeed, up to this period this operation for stone has not been performed in our country above some thirty times by MM. Sanson, Dupuytren, Peserat, Castara, Willaume, Cazenave, Dumont, Taxil, and some others. We shall be enabled, after a survey of the parts which the instrument must encounter, to judge of what hopes may reasonably be founded upon it.

§ 1. *Anatomical Remarks.*

In all the different procedures thus far advised, the cutting instrument acts only in the interspace which separates the body of the bladder of urine from the membranous portion of the urethra as it enters the horizontal aponeurosis of the pelvis. It is therefore this part of the urinary passages, and that part of the rectum which answers to them, which it is particularly necessary for a surgeon to know.

The Bladder considered in its posterior wall, offers its trigonal space whose base usually looks towards the recto-vesical cul-de-sac in the peritoneum, and at its lateral angles receives the terminations of the ureters. The length

of this trigone vesical is from twelve to fifteen, or eighteen lines from before backwards, and usually two inches across. On the median line, it is only separated from the rectum by a dense lamellar tissue, which expands as it goes towards the sides, where the vesiculæ seminales, having the vas-deferens on their inner edge, come, converging towards its anterior angle to divide it from the rectum, and push it a little forward. Its anterior angle, which forms the entrance of the urethra, at the instant of its engaging in the prostatic cone, give origin to the uvula vesicæ, *or luete vesicale*, which continues forwards under the appellation of *crista urethralis*, and afterwards under that of *verumontanum*.

That portion of the urethra which follows it, is especially remarkable as connected with the seminiferous tubes and the prostate itself. These canals, which open sometimes nearer, and sometimes rather further from the median line, but in such a way as never to be more than a line apart from each other in a natural state of parts, and often blending, as it were, upon the free edge of the verumontanum, diverge thence and insensibly separate as they approach the termination of the vesiculæ seminales; that is to say, as they come towards the inferior and somewhat lateral surface of the point of the trigonal space, where they are four or five lines apart. The prostate gland just here presents frequently at its inferior surface a sort of groove which embraces the front of the rectum. The ejaculatory canals cross the prostate from behind forwards, from within outwards, and a little downwards from above. Its thickness upon the median line, is only, as we have seen already, from five to seven or eight lines, and sometimes less. Lastly, its posterior edge extends, in certain persons, from three to four lines back of the urethra under the trigone, so as to form a knob there, the importance of which will hereafter appear.

The rectum, which is movable, and maintained in front of the os sacrum by its peritoneal reflection, a little to its left in the upper part, presents no interest until it descends far enough to apply itself to the anterior surface of the coccyx. There the peritoneum leaves it, to mount up behind the bladder, and to line the recto-vesical excavation. The intestine continuing to advance obliquely and downwards, enters into contact with the vesical trigonal space, with the ends of the ureters, with the vesiculæ seminales, and with the vasa deferentia. When it has got beneath the prostate, and upon the point of the coccyx it is enveloped in the ring of the sphincters, of the levator ani and coccygeus muscles; it changes its oblique direction to become vertical, and end in the anus. As, on the contrary, the urethra at this point leaves the axis of the body to pass forward, so there naturally results a larger or smaller interspace between this canal and the rectum; that interspace of which we took notice above; and which after its two principal limits—I have thought might be called *recto-uretral* or *bulbo-anal triangle*. There are eight or twelve lines from the opening of the anus to the top of the prostate. Before we reach the tubercle on the uppermost edge of this gland, is a distance of an inch and a half to two inches: the peritoneal cul-de-sac being separated from it only by an interval of twelve to fifteen lines, sometimes of six or eight lines merely, as I have seen in two subjects, as M. Senn has seen it only two or three lines in width. In a normal state in the young subject, the rectum begins to contract at the moment it passes behind the neck

of the bladder, and above this point forms merely a cylindrical canal of greater or less size. In advanced age, or in persons of a habitually costive habit, a different disposition is frequently remarked.

In the first place this intestine may offer a large excavation, which has more than once been seen to extend on either side of the prostate and trigone vesical, so as almost to come under the edge of the knife in cutting for stone, either lateralized transversal or even completely lateral. In the second place it may also enlarge anew after it has passed beyond the posterior edge of the prostate before it clears the sphincter externus, as if to form between the anus and urethra a cul-de-sac, which in traversing the recto-urethral triangle in bilateral cutting it may be difficult to avoid.

The parts, though few, which exist between the bladder and intestine, deserve perhaps a passing mention. There are no vessels on the median line, and the cellular tissue at that spot is almost always destitute of fat. Laterally these two organs being, by their rounded form, drawn in opposite directions must leave two sorts of furrows, larger as we approach nearer the parietes of the pelvis. These furrows contain, besides the vesiculæ seminales, vasa deferentia, and ends of the ureters, and below the posterior angles of the prostate, an exceedingly lax lamellar tissue, particularly outwardly, where it is continuous with the rest of the pelvic cellular tissues; oftentimes some fat, some arteriolæ and vesicles which pass upon the sides of the neck of the bladder and the forepart of the intestine.

§ 2. *Methods of Operation.*

Upon this principle, M. Sanson ascertained that recto-vesical cutting might be performed in two distinct ways; one in which the prostate, urethra, and inferior extremity of the rectum alone are divided; another, in which at the same time the bas-fond, or rather the trigone vesical, and the intestine are attacked, so as to save the two anterior thirds of the gland. In Italy, Vacca and M. Barbantini decided at once upon the former, so as in a measure to appropriate it to themselves. Geri, Guidette, &c. attached themselves to the second way, on which M. Sanson himself had laid most stress. Upon the whole, there is no great difference in performing them.

Procedure the first.—The staff held by an assistant is to press accurately upon the median line, so as to depress the anterior face of the rectum. The surgeon introduces the left forefinger to a depth of ten lines into the anus; turns the pulp forwards and the nail backwards; slips in flatwise upon this finger a sharp bistoury two inches long; plunges its point into the groove of the staff, having first turned its cutting edge upwards; then he raises his right wrist and cuts from behind forwards, that is to say from anus to urethra, the lower part of the sphincter externus, and also all the parts contained in the recto-urethral triangle, drawing his bistoury with strength towards the bulb. He then seeks to recognize at the bottom of the wound the point of the prostate, and places his finger upon the groove of the staff through the membranous portion of the urethra, its cubital edge being towards the symphysis pubis, the nail towards the left ischion. The same bistoury, held like a pen, is then plunged into the groove of the staff, and slid along it into the bladder. It is then withdrawn, lowering the hand a little, so as to divide almost the

whole of the prostate, and such soft parts as may have escaped in the first incision. By this means the sphincter externus, the interlacing of the fibres of the transversi and bulbo cavernosus muscles, the seat of junction of the fibrous laminæ of the perineum, the membranous portion of the urethra, the prostate from top to bottom on its lower surface, and the forepart of the rectum beneath the trigonal space, are divided. One ejaculatory duct also is likewise comprehended in the incision, for chance alone would so unerringly direct a bistoury on the median line as that it should pass directly between them. If, as is easy enough to happen, the incision deviate to one side, it will soon strike upon a distant part of this canal, and might even touch the end of the vas deferens, or even on the inferior end of the vesiculæ seminales of the same side. No considerable artery presents itself, not even the abnormal branches indicated when speaking of cutting through the perineum.

The Italian professor advises instead of the procedure of M. Sanson, that the index finger be so applied upon one surface of the bistoury, the handle of which is enclosed in the hand, as that its fleshy part pressing a little upon the instrument may entirely cover its point; that it be carried in this way to the required depth; that when this is done, the cutting edge of the bistoury be turned forwards, so that the finger may be placed on the back of the blade, and the section of tissues performed at one stroke, as was before stated. The left fore-finger remaining unengaged feels for the groove in the staff, in order that the bistoury, whose cutting edge must then look downwards, may be directed on the membranous portion of the urethra, and from before backwards; that is to say, in an opposite direction to that which until then it had pursued to cut the prostate and tubercle at the vesical orifice.

Procedure the Second.—The first incision, which is commenced rather higher up, does not end as near the bulb of the urethra as in the first procedure. The left fore-finger pressed into the wound no longer seeks to recognize the point of the prostate but its base; and the bistoury to strike the groove of the staff is to be passed in on a level with its posterior edge, or at most of its two lower with its upper third. It is then pushed on into the bladder, so as to open the inferior wall for about an inch by withdrawing it from before backwards and rather downwards from above. The solution of continuity involves, when this method is adopted, the same parts as the preceding, so far as the first incision is concerned. The second stage of the operation on the contrary saves a portion of the urethra and of the prostate at the place where the seminal canals touch, and which they cross, wounds instead the trigonal space, and approximates nearer the recto-vesical excavation. Should the incision not be exactly in the median line, it may involve the ejaculatory ducts, the seminal vessels, the vasa deferentiá, and even if the deviation is very great, the ureter. It is evident also that the peritoneum runs great risk, and that if it dips down lower than common it will not escape. It must be remarked also, that according to the direction given the bistoury as it is withdrawn, the wound should be more of the bladder than of the rectum; be much longer consequently above the inner surface of the first than the second of these organs; so that the mucous membrane, and a large part of the fleshy membrane even of the rectum, comes down in the form of a valve several lines beneath the wound in the bladder. Some Italian surgeons endeavored to perfect M. Sanson's operation by placing some dilating instru-

ment within the rectum. M. Geri, for example, had contrived a large gorget for this purpose. At first, this modification did seem to fulfill the end of guarding against this movableness of tissues, against which M. Pezerat had so much difficulty in struggling in the recto-vesical cutting which he performed, and to render its incision nearly less difficult. However, Vacca opposed it very violently, and it is indeed soon seen by reflection that it must needs augment the difficulty of the operation.

But lithotomy per rectum is not alone to be objected to on account of the difficulty of its execution; and no amelioration proposed in this respect deserves any very great attention.

We can, I think if it is wished, estimate the value of the recto-vesical operation for stone without difficulty. Its greatest and most indisputable advantage is that it guards wholly against hemorrhage: first, because there are no vessels naturally located between the parts which are divided: secondly, because no vessels springing from anatomical anomalies, have ever been detected in them. The second advantage is, that it is extremely simple. But upon this point let us not be deceived. Division of the mucous membrane of the anus, rectum, and posterior portion of the perineum, is in certain persons attended with all the difficulty of which M. Pezerat speaks, whatever precautions may have been taken to make tense the tissues.

In the third place, it may be urged as an objection to those who attribute to it the making of so easy an exit for the urine, as that infiltration is never to be feared; that the recto-vesical septum being pulled about by the instruments or the stone during the operation, is of such a nature as sometimes to detach itself, and then we can see nothing to render infiltration of some drops of urine into the surrounding cellular tissue impossible. Besides which, this infiltration almost necessarily occurring above the pelvic aponeurosis will very soon spread to all the sub-peritoneal cellular tissue of the organ.

Its advantages of allowing passage to enormous calculi, and of admitting of a very extensive incision, may with equal propriety be disputed. In my opinion it is a serious error to attribute this difficulty to the degree of separation between the bones. No more than Scarpa can I conceive how, in any method of cutting the inferior strait when of regular formation can impede the extraction of a stone. The difficulty always arises from the opening into the bladder. When this is made only upon the bas-fond, it is not possible to give it an extent of more than twelve or fifteen lines, because there is this distance only between the prostate and the peritoneal cul-de-sac. What, then, is the advantage, when we can obtain, in bilateral cutting for example, an opening of from fifteen to twenty lines? If the incision is confined to the prostate with the hope of exceeding its bounds, the division, supposing it at its extreme length, can be only eight or twelve lines. If we go beyond this, necessarily we exceed and cut the edge of the gland, since in this direction its radius is but six or seven lines. Were the two procedures to be combined, the opening might be of an extent of an inch and a half or a couple of inches. Thus far, this has not been proposed by any one; and besides, the bilateral cutting again is calculated to produce a very extensive division. Finally, if the rule be no longer adopted which advises us to confine the incision to the circle of the prostate, it is evident that by the bilateral method we can cut the neck of the bladder on either side, and so produce a wound of two inches or two inches

and a half wide; which it would be impossible to do on recto-vesical cutting, unless by a voluntary exposure of the peritoneum.

It appears that in speaking of this operation something has been attributed to the division of the perineum and membranous portion of the urethra.

The same error, moreover, occurs in almost every discussion relative to the other methods of cystotomy. But it is easy to satisfy oneself, that the enlargement of the posterior opening of this canal alone can enter into the account. Enlarge it directly backward, and you never will obtain more than an opening of seven or eight lines without going beyond the prostate, whether your external incision is confined to the perineum or whether it at the same time comprises the extremity of the rectum. If you prolong it an inch or an inch and a half, you will cross the whole length of the trigone vesicale, and give your wound only an extent of two inches, while you incur the utmost risk of cutting the peritoneum. On the contrary, the double oblique incision allows of our going as far as twenty and some lines over without encroaching on the summit of the bladder, and if we are not afraid to exceed the prostatic limits, it may be yet much further increased evidently than by the posterior method.

As to injury of arteries, it is well to inquire if it can counterbalance the danger of recto-vesical fistulæ.

In transverse cutting, it is almost certain that bleeding will not occur once in a hundred times. Recto-vesical cutting is followed by fistula urinaria at least once in four or five times.

The hemorrhage is far from proving always fatal. Fistula is a disgusting infirmity; for the most part an incurable one.

So far recto-vesical cutting has been followed by almost as great a proportion of deaths as the operations performed upon the perineum.

It has the special disadvantage of inevitably cutting one of the ejaculatory ducts. Experience proves that it is often succeeded by swelling and other serious disease of the testicles. The peritoneal reflexion had been opened into in one of M. Geri's patients. Out of six, M. Janson of Lyons lost two; in whom the intestine was acutely inflamed. It is stated by authors that the bladder is often inflamed owing to the entrance of stercoraceous matter into it. Scarpa states that in two patients seen by him, it was gangrenous. The vesiculæ seminales have also been opened into. Abscesses within the pelvis have many times been met with. In short, out of one hundred operations performed in this way up to the present time by MM. Sanson, Dupuytren, Camoin, Pezerat, Willaume, Cazenave, Dumont, Urbain, Sanson, Taxil, Barbantini, Vacca, Geri, Guidetti, Farnese, Giorgi, Giuseppe, Cittadini, Mori, Lancisi, Castaldi, Cavarra, Regnoli, Bandiere, Sleihg, Clot, and Wenzel, twenty deaths are enumerated, as many fistulas, and other occurrences which have endangered the lives of some of the patients.

Upon the whole, recto-vesical cutting seems to have no real advantages over bilateral cutting; so much so, that if it were decided that the latter was insufficient, it would perhaps be better to cut above the pubis than through the rectum.*

* I have been equally unsuccessful with M. Civiale in ascertaining whether it be true, as M. Wessely assured me it was, that vesico-rectal cutting had been invented in Germany in 1813.

Art. 3.—*Hypogastric Operation for Stone.*

The idea of opening into the bladder above the pubis, for the purpose of removing calculi from it, is not formally expressed by any ancient author. It appears certain that Philagrius of Thessalonica, in advising an incision "*superne juxta glandis magnitudinem,*" meant merely to speak of calculi which were stopped in the urethra, and that his only object in opening the back of the penis was to prevent fistulæ, which were much more to be feared from cutting into the inferior wall of the excretory duct of the urine. On the other side, I do not see upon what authority Mr. Samuel Cooper thinks that the operation performed by M. Collot, 1475, has any reference to hypogastric cutting rather than to nephrotomy, or to any thing else which he pleases. The merit of it incontestably belongs to Franco; however, this surgeon was induced to do it from necessity in spite of himself, and sedulously forbids others to follow his example. Rousset or Rosset, in 1581, who gave a labored description of it twenty years after the publication of Franco's book on the subject, is consequently the first person who positively recommended and endeavored to establish its general adoption as an operation. Still, from what he says, it might almost be supposed that other practitioners cotemporary with him had likewise alluded to it. Be this as it may, Henry III, who had promised to give into his hands three or four criminals as an experiment, having died, Rousset could never perform it on the living subject; and since him no one seems to have thought of it, until 1635, in which year Mercier defended it before the Faculty of Paris, in a thesis by Nicolas Pietre. At length some surgeons adopted it, and Collot relates that in 1681 Bonnet performed it before Petit at the Hotel Dieu with entire success. Proby, failing to extract a stone by the usual methods, had likewise recourse to it some years afterwards; and Groenvelt publicly advocated it in a work published in London in 1710. So little was it generally known, however, that Douglas of Dublin, in 1718, for a short time considered himself as its discoverer. The success derived from it by the last named surgeon, having opened the eyes of the profession, and forthwith engaged the attention of Cheselden, Macgill, Thornhill, Middleton, Bamber, and Pye, in England; and of Morand, who performed it at the Hospital of Invalids, May 27, 1727, on an officer sixty-eight years old, and saw it done on the 10th of December following at St. Germain en Laye by Berier on a child named L. Amon, four years of age. It was likewise practised by J. Robert, Sermes, Kulmus, Heuermann, and particularly by Heister, who caused it to be defended in a thesis sustained by Weise at Helmstadt on the 8th of December, 1728, and who obtained reports of cases of it from Runge and Præbisch, so that it seemed almost about to meet with general adoption. Cheselden, in 1727, had performed it upon six patients with the loss of only one; Douglas, with a similar loss out of nine persons who underwent it; Thornhill lost two persons out of twelve; Macgill one in four. Notwithstanding the numerous efforts excited by the appearance of frere Jacques's method, this operation was soon abandoned and it had almost ceased to be thought of when frere Come in turn undertook its readoption in 1775. Since then it has been advocated by Leblanc

of Orleans, and Bazeilhac, and Lassus, and also MM. Deschamps, Dupuytren, Roux, Boyer, de Guise, and several others have performed it, but merely as an exception and not as a general rule. Notwithstanding every defence made for it, and the numerous instances of success obtained in France by M. Souberbielle, the inheritor of the principles of Come and Barzeilhac, the high apparatus relapsed into dis-use, until, owing to some proposed improvements by MM. Scarpa, Dupuytren, Sir Edward Home, and Gelher it has a third time been attempted to set forth its advantages, and to substitute it for the perineal methods of operating. It consists in an incision of the anterior surface of the bladder through the wall of the abdomen.

§ 1. *Anatomical Remarks.*

In all the operations for stone done by the lower apparatus, the instrument can arrive at the bladder only by exposing very important organs to injury; and such is the distribution of parts, that they will not always allow of an opening large enough to permit the passage of bulky stones. On the contrary, it seems that by opening into the bladder through the hypogastrium, there is scarcely any risk to be apprehended, and that it will always be practicable to make the incision of the tissues of any required dimensions.

The empty bladder, taken together, forms in the adult male a conoidal pouch, whose summit extends through the medium of the urachus towards the umbilicus; and whose base descends upon the rectum, forming a curve below the pubis to give origin to the urethra. It has often since the time of Celsus been repeated that it inclines a little to the right. The ancient latin dogmatist having confined himself to this simple assertion on the subject, some of his commentators suppose that the summit, and others that the fundus is to lean towards the left. I, like my predecessors adopted this same idea of the inclination of the bladder in an earlier work; but I have since satisfied myself that the appearance has been taken for the reality. The urachus invariably terminates its summit, and the urachus is invariably placed behind the median line. Again, the urethra is placed exactly in the direction of the axis which separates the body into two halves, and never in a natural state leans more towards the right than towards the left. The bladder then stretched between the urethra and the urachus inclines neither from above downwards, nor from below upwards, nor from right to left. The errors on this subject may alone have been caused by its connection with the rectum. In fact the defecator organ does push it more sometimes in one direction than in the other, whence it happens that it appears more dilated, wider, more inclined in short in that direction in which it is least frequently and least powerfully depressed. Now, as the rectum is generally to the left before it engages beneath the prostate, it clearly appears why the body of the bladder, naturally in relation with this part of the digestive tube, should seem to lean a little from left to right in a line from the urachus to the prostate.

From these remarks it follows that as it respects the position of the reservoir of urine, perineal operations for stone may indifferently be excuted on either the right or left sides; and that in the other methods an incision along the median line of the body is sure to discover its vertical axis.

The peritoneum, by which the bladder is partially enveloped, deserves here

our most serious consideration. After having covered its entire posterior region, and its summit (which is its fundus when distended), it separates from it on a level with the upper strait to spread over the hypogastric portion of the parietes of the abdomen. During its distension, as it fills the bladder crowds back this membrane gradually, so as to leave it at a distance of an inch, or even two inches from the upper edge of the pubis; hence its adhesions at this spot are very feeble. The peritoneum is separated from the symphysis pubis, in the hypogastric region, by an interval so much the larger as it is examined nearer to the neck of the bladder; which interval is filled by an extremely distensible lamellar cellular tissue, which is habitually much loaded with fat. This tissue which is no other than a portion of the general fascia propria, presents about the same character as it does in the fossa iliaca and behind the attached edges of all the folds of the mesentery.

In most subjects, it terminates in giving strong adhesions to the peritoneum; particularly as we approach the junction of the two upper thirds with the lower third of the space which divides the pubis from the umbilicus. These adhesions more speedily contract outwardly toward the iliac regions than upon the median line. Thus the anterior face of the bladder is separated from the symphysis pubis merely by the lamellar adipose tissue of which I have just spoken. This pouch, when it rises above the upper strait is at once in contact with the posterior surfaces of the recto muscles, or of their aponeurosis, without any interposition of the peritoneum; and it is consequently possible to open into it through this spot, without cutting its serous covering. Be it observed, that between the symphysis and it there are neither arteries nor veins, nor other important parts to be avoided; but let it be remarked also that the slightest traction or effort is sufficient to detach it, and thus to create a cavity more or less wide and deep between the bladder and outline of the pelvis.

The Walls of the Belly consist in the region now under consideration, of parts which it is easy to remember. The skin here is covered with hairs, is not very movable, and of considerable density, especially at its lower part, at which it would be difficult to follow Middleton's advice, of pinching it up into a fold before cutting it. The cellular layer here becomes a fatty puniculus or membrane which often acquires a thickness of an inch or more. In it we find sometimes veins of some size, and some twigs from the cutaneous arteries, and from the superior pudica externa. The aponeurosis from the external oblique, joined to the anterior lamina of the internal oblique, terminates in it, as in the remainder of its extent upon the linea alba.

The muscles which are found here are the pyramidales, the terminations of the sterno-pubic, and much more outwardly a slender portion of the abdominal oblique muscles, which are not at present to engage our attention. The recti muscles which are divided from each other by the linea alba are in more than one respect remarkable. Their tendon growing more flat contracts more and more, is much thinner outwardly than within, in such a way as that as it comes to be inserted upon the edges of the ossa-pubis near the skin, it leaves a portion of these bones uncovered behind, and inwardly projecting. The outer edge of this tendon being very thin, and continuous with the aponeurosis oblique muscles, the parietes of the abdomen are infinitely less thick at a distance of two inches outwards from the symphysis than on a level even

with the recti muscles, and it has been thought possible to arrive at the bladder, by penetrating them just at this spot. Their posterior surface is covered by a layer of adherent cellular tissue to a certain point analagous to the deeper lamellæ of the fascia-superficialis in general. On the median line they are divided from each other by a fissure which deepens more and more in proportion as we descend towards the strait. When it has reached the pubis, the fissure becomes a triangle whose base is downwards, in which exists abundance of cellular tissue and fatty flakes, such as were spoken of a short time previously.

The epigastric artery, the only important vessel which is observed in the thickness of the layers, reaches the edge of the recti muscles to penetrate the fibres on a level with a line drawn transversely from one external superior spine of the ileum to the other. As it gives off no branch of any size which goes towards the median line, we need not fear to wound it in cutting through the hypogastrium, unless that in the desire to penetrate into the little aponeurotic space, which is bounded within by the tendon of the rectus muscle, below by the ligament of Fallopius, and outwardly by an imaginary line which the artery would represent, the incision had been made a good deal too much towards the fossa-iliaca.

The spermatic cord passing in an opposite direction and lying at a still greater distance is equally shielded from danger. In going regularly through the different layers of the wall of the abdomen, we shall encounter beneath the common integuments upon the median line, 1st, the cellulo-adipose cushion; 2d, the linea alba, three or four lines thick, the pubio-vesical triangle; 3d, the cellular tissue, which in this region is very abundant; 4th, the anterior surface of the bladder.

A little to one side we meet with, 1st, the very thick external aponeurosis; 2d, the pyramidalis muscles; 3d, a thinner fibrous layer separating these muscles from the recti; 4th, these last named muscular masses, sheathed behind by a very thin fascia; 5th, the fascia-propria, or lamellar tissue as above described. More outwardly still, the united aponeurosis of the three wide muscles of the abdomen alone offer for division before we come to the subperitoneal cellular tissue.

The arrangement of the pubis is another point which the operator must ever bear in mind. At the symphysis, they are in general not more than an inch and a half or two inches high; so that unless they be extremely short, the anterior surface of the reservoir of urine may easily be brought to their upper edge. The convexity of the form of the ossa-pubis from above downwards is the reason, consequently, why it is easy to make a stone slip in a contrary direction from the bladder outwards, and why it is advantageously employed as a fulcrum for lithotomic instruments, and why the wall of the bladder may without difficulty be cut as far as their lower edge, that is, from the cervix vesicæ or to the prostate. Their body increasing in thickness, becoming larger and larger as we retreat from the median line, it results contrary to what M. Drivon asserts, that the bladder is further from the integuments as we approach the fossa-iliaca of either side, and that if the converse can be admitted, we should act upon the sort of vacuum apparently created by the vesico-pubal triangle. Sex and age induce some changes of structure in the arrangement of parts which we have now described. In the

female the symphysis being shorter, and the bladder naturally raised up by the vagina and matrix, it is usually higher above the pubis than in the male.

It happens besides, as a consequence of frequent deliveries, that it enlarges transversely, so as that almost it may be said it divides into lateral portions, and that it might be opened on the side with less danger than in the other sex. To these shades of difference has been attributed the greater success obtained in women from this operation than in men. In youth the narrowness of the pelvis, the lowness of the symphysis, the smallness of curve in the sacrum, the relatively great bulk of the rectum, the considerable length of the bladder conspire to raise this latter organ very high above the superior strait generally, and so its anterior face may be widely opened into, without any danger of dividing the serous membrane. It will be conceded nevertheless, that numerous anomalies and changes of a pathological character may alter these particulars, and invalidate the justness of the assertion which I have now made.

§ 2. *Examination of the Methods of Performing it.*

Fewer procedures have offered for the high apparatus than for perineal cutting, and the methods which belong to it can only be regarded as modifications of each other. I shall consider them under three principal heads to analyze them more in order; 1st, that mode in which you operate without a staff being previously introduced; 2d, that in which the very reverse is done; 3d, that which differs from either, in having an accessory opening made beneath the pubis.

1. *The Method of Rousset.*—The first plan laid down for performing hypogastric cutting, is that which Rousset has described. He began by injecting barley water, tepid water, milk, or some vulnerary decoction into the bladder, so that by its distension it might rise above the pubis. The penis of the patient was either tied or held by an assistant, to prevent the fluid from flowing out against the wish of the operator. With a good razor the integuments and aponeurosis upon the median line were divided. A slightly concave bistoury was then carried obliquely downwards and backwards, between the symphysis pubis and the bladder, the back of the blade towards the bone, so as to open this pouch with the utmost care. If the opening were very large, the bladder would at once be evacuated: it must be merely sufficient to allow of the introduction of a lenticular bistoury, which immediately enlarges the incision from below upwards, not going far enough however to reach the peritoneum. Then the stone was withdrawn with the fingers alone, or artificially armed with stalls, with a scoop, or with forceps.

a. Douglas modified the procedure of Rousset in two points of view. The organ must be very moderately distended by the injection, according to him not to paralyze its fibres, and because its extreme distension is often quite insupportable. For the razor he substitutes a convex bistoury. The straight bistoury, which he employs instead of a curved bistoury, serves both for making the puncture into the bladder, and for at once enlarging the wound instead of resorting to the probe-pointed bistoury.

b. Cheselden, who likewise does not approve of much distension, advises the patient as much as possible to retain his urine, and to throw in a quantity

of liquid equal only to what they would naturally have voided. When he has laid bare the aponeurosis with a convex bistoury, and divided the linea alba with a straight one, he takes a sharp pointed concave bistoury, to open the bladder from above downwards, and not from below upwards, as Rousset and Douglas had advised.

The curved scissors which McGill has recommended instead of the straight bistoury in this latter stage of the operation, expose the peritoneum too much to injury to be ever adopted, and in all respects are of so little importance or advantage as not to entitle the method to an analysis.

c. Morand so alters the procedure of Rousset, that he placed his patient differently, his head and chest lower than his pelvis, and the legs fixed to the bed posts. He plausibly insists on the dangers of forcing injection to any extent, and endeavors to demonstrate its inutility. He is content with the common straight bistoury for the incision of the parietes of the abdomen, and the concave one for that into the bladder. He appears to have originated the idea of using the left forefinger, curved as a hook, to keep the bladder at the upper angle of the wound, whilst its dimension is being completed as Heister had done before him.

d. Others, particularly Le Dran, thought that the peritoneum would run infinitely less risk of being wounded if it were cut into crosswise instead of being divided from above downwards. Winslow asserted, that the necessity for injecting it, might be done away with, by making the patient drink freely of a diluent tisana for some weeks before he underwent the operation; and he told Morand that the position adopted by him was ill-suited to the end. If we rightly comprehend him, it appears that Thibaut, of the Hotel Dieu, had an idea of returning to the incision from above downwards, and like La Peyronie, was of opinion that the bistoury should be so passed into the bladder at one stroke, as on withdrawing it to divide all the tissues.

Lecat followed this advice in operating on two patients by the high apparatus, in 1742 and 1743. His cystotome bistoury, which he plunged in as if by puncture, served him for dividing the bladder upwards, then for a moment to keep it suspended by means of a projection on its convex edge, suddenly turned in this direction, until he had replaced it by a suspensor hook.

e. Of late years the procedure of Rousset has been subjected to fresh modifications. M. Baudens, a young surgeon from the military hospitals says, that he has found it a good plan not to introduce any fluid into the bladder; to open this pouch, as Pietre, Solingen, &c. had advised, a little on one side; to carry the left forefinger down to the posterior face of the pubis, to push the peritoneum up from below, and make it and the bladder tense; to pass in the bistoury to its cavity from above downwards; to employ his finger as did Morand, and so continue the incision in the same direction without removing it, as far as the neck of the bladder. Moreover, M. Baudens thinks that when the removal of the calculus is attended with some difficulty, we should divide the rectus muscle laterally, and also the lips of the wound in the bladder, as had before been recommended by McGill and Le Dran.

f. A particular instrument of an extremely ingenious construction was contrived by M. Tanchou to facilitate this procedure. It is a sort of flat trocar, the sheath grooved on one edge, articulated at some distance from its extre-

mity, and made into a bistoury by a stem with a cutting edge. The operation is performed in the following way. The operator makes his incision on the median line down to the forepart of the peritoneum with a convex bistoury. By the assistance of the left forefinger carried to the bottom of the wound, he detects the fluctuation of the bladder, which he has previously moderately distended by an injection of tepid water; he then passes in his trocar, from above downwards and before backwards, draws out the cutting edge by means of a spring; the sheath then bends at a right angle, and forms a suspensor hook which is developed within, and on the lower edge of which a common probe-pointed bistoury is conveyed in to enlarge the wound as much as may he requisite.

g. Lastly, M. Verniere, conceived that an advantageous change might be made in practising this operation by the performance of a previous one, consisting in incision of the wall of the hypogastrium, and then in placing between it and the front of the bladder a flat surface (*plaque*), intended to compress from behind forwards the peritoneum against the inner surface of the recto muscles for some days. The adhesions following the pressure thus made, will, he says, allow of our opening the bladder with every security, and without the slightest danger of entering the cavity of the abdomen. An idea analogous to that of M. Verniere, has just been communicated to me by M. Vidal (of Cassis). This surgeon proposes to perform the operation at two separate times, between each of which he allows an interval of several days. The first stage consists in an incision of the tissues which are external to the bladder, and the object is to render the cellular tissue impermeable by inflaming it. The second contains the opening into the bladder, which according to the author is thus exempt from the dangers of urinous infiltration.

Of all these modifications, no one in reality is worthy of a decided preference over the others. I think the wisest of them, as far as concerns the operation properly so called, is that of Morand. To advise the patient to retain his urine so as to have the bladder distended, is counsel which it is easier to give than for the patient to follow. To be convinced of this, it need only be recollected how very often calculous patients are compelled to pass their water. Injections, carried to such an extent as to render the bladder salient above the symphysis, cannot in reality be endured; but in the majority of cases we experience no difficulty in distending it moderately by the introduction of some emollient liquor, which will suffice to indicate its presence easily recognizable behind the pubis, by the finger introduced through the wound in the linea alba. As to the nature of the fluid to be injected, milk, which Middleton seems to prefer, is evidently less suited by its tendency to decomposition than mallow infusion, barley water, or better still a certain quantity of tepid water only. Air, the suggestion of which is attributed to Solingen, although spoken of by Rousset, who says that in his time they were advised to fill the bladder with wind, could have no advantage whatever over a fluid, and deserves the neglect which it has received. Equal justice has long been done to the precept of Bamber, that the injection is to be made only after the opening of the linea alba, and to that of Middleton, who thinks that it should at least, then be pushed a little further than was done before the operation commenced.

An incision from below upwards with a straight bistoury, as in Douglas's

procedure, or with Rousset's probe-pointed bistoury, would in truth allow of much certainty in acting by taking the pubis for a fulcrum; but undoubtedly we are by this method too much exposed from the instrument's going further than we wish to perforate the peritoneum, or as Cheselden says, *to open the belly*. If we adopt the incision from above downwards, it is indifferent whether it be completed with scissors, a probe-pointed bistoury, straight or curved, or with the common straight one, if it be done with a steady hand. A transverse incision of the bladder would, as Winslow has remarked, have the inconvenience of presenting a wound perpendicular to the direction of outer incision, which in retracting behind the bone would be singularly liable to cause urinal infiltration. Moreover, it is very certain that to divide laterally the recto muscles as was done by Pye, at another time by M. Dupuytren, and which in our time Gehler wished to establish as a rule, is suitable only in particular cases, such as when spasmodic contraction, sufficiently violent to prevent the introduction of forceps or fingers through the wound into the bladder, occurs, as I once witnessed in a patient upon whom M. Roux operated in 1827 at La Charite. M. Baudens's procedure, notwithstanding its wonderful apparent simplicity, has the serious drawback of causing too much tearing of cellular tissue in detaching the peritoneum. There can be no doubt that in a case in which the bladder was concealed quite in the bottom of the pelvis, the absence of injection into it would render the operation extremely difficult.

The mere announcement of M. Veniere's idea, will suffice I fancy to give all an opportunity to appreciate its worth. That of M. Vidal is more simple and more reasonable. The wisdom of M. Tanchou's contrivance cannot be disputed; simply, as it requires a particular instrument having no other advantage than serving to carry a hook into the bladder, at the same time that it is entered by puncture, and that the puncture of this sac by a bistoury admits the finger or some suspensory instrument to be introduced, I presume that the use of it will be neglected by surgeons, and that good surgery can dispense with it. Some old surgeons, however, had previously felt the want of it, for Heister advises the puncture of the bladder by a trocar, grooved so as to serve as a director to a bistoury afterwards.

2. *The Method of Franco.*—Dionis and Tollet, who have treated of the high apparatus, think that the surgeon might follow the advice of Franco, whose method was to carry two fingers into the rectum to raise the stone up to the hypogastrium, and then to cut down upon it a little to one side of the linea alba. They are of opinion that this is a very easy and simple method, and much more certain than that of which Rousset speaks. If the stone is small and the pubis sufficiently low, and the parts altogether thin enough to allow the fingers thus to push the foreign body up above the pubis, this procedure would be very advantageous and deserve adoption. Proby put it in operation, and by means of it Lassus and M. de Guise succeeded in removing stones from the bladder, which through the perineum they could not extract. In fact, this is nothing but the apparatus-minor of the ancients, applied to cutting by the hypogastrium, with this difference, that it is easier to cut down to the stone above the pubis, than when it has to be extracted from the inferior strait. It is useless altogether to give the steps of the operation in detail. Franco merely says, that his patient was operated on "upon the pubis, a

little to one side and upon the stone, whilst he raised this up with his fingers which were in the fundament on the other side, confining it by the hands of a servant who pressed upon the lower belly." It is well to remark, *en passant*, that Franco had not previously, as a number of books relate, and as is stated in the Dictionary of Practical Surgery, cut into the perineum of the child of two years old of whom he speaks—and that it was only after he had seen every effort unsuccessful in bringing down the stone that he resorted to "cutting the said child above the os pubis."

3. *Method of Frere Come.*—In the successive improvements which were made in perineal lithotomy the hypogastric operation seems to have followed every change. For a long while it was thought necessary to make the stone descend towards the neck of the bladder to cut the parts over it; the same was the case in the high apparatus. The plan of distending the bladder with injection was a precaution soon adopted in it. Bamber, Cheselden, and Foubert, in the last century, imagined the same thing in perineal cutting so as to dispense with the staff. And since this instrument is believed to be indispensable now in all species of the low apparatus, a host of authors have likewise advised its use in the super-pubic method. Rousset mentions without advocating it. It seems, that in his time it was a hollow and crested staff which was at once a catheter through which to throw in injections if thought advisable, and as a "catheter to direct the incision after the manner of the Marianists;" which means, no doubt, that the convexity or groove was turned forwards, not a very easy thing to do. Still later the staff was advised by Pietre and Heister, &c.; by some to distend and raise the bladder; while others had caused its concavity to be grooved, in a manner proper for carrying the point of the bistoury along it.

The instrument which has in this respect excited most attention, is that invented by brother Come about the middle of the last century, and which gave the monk so great a predilection for the high apparatus, that between the years 1758 and 1779, he had performed it one hundred times. This instrument, known by the name of "*sonde a dard*," consists of, 1st, a silver catheter, opening by a fissure on its concave side, ending in a beak which rather projects backwards, and has one or two rings at its outer end; 2d, of a stem much longer, which ends in a triangular steel point, also grooved on its concave side, and which has a flat blunt knob on its other extremity. These two portions, the last of which is always kept within the other in such a way as to escape as soon as pressure is made on the button or knob of its free extremity, form an instrument whose mechanism is exceedingly simple. It is introduced in such a way as that its beak may glide from below upwards behind the symphysis, and rise up above the pubis, passing against the inner side of the anterior region of the bladder. The abdominal parietes being divided, its point or beak is made to bulge up a little into the wound by pressing on the top of the handle as if to push it backwards, and so as to depress it. The surgeon takes hold of it through the coats of the bladder by its projecting part with his thumb and forefinger; or else he applies upon its fore part a canula hollowed out and shaped like a funnel. The knob then being pushed from below upwards perforates the bladder as it escapes from the "*sonde*," and shows itself outwardly. Whether this knob unscrews from the stem so as to leave the latter in the wound, or whether they be in one

piece, the bistoury is adapted to the groove in its concavity, then passed from above downwards, and from before backwards to cut the wall of the bladder to a suitable extent. Nothing then remains but to withdraw the stylet, whose projecting beak has not yet quitted the wound, back into its sheath, and then to take out the instrument itself. The other stage of the procedure does not differ from that of Morand's.

The *sonde a dard* thus completely does away with the necessity of injections, for it makes the parts suitably tense; and its grooved stem makes an excellent director when the opening into the bladder is to be enlarged with the bistoury. Scarpa and M. Belmas have proposed certain modifications in it, with the view of rendering its use yet more efficient. For example, it is often objected to as escaping entirely through the puncture it has made, and as allowing the bladder to contract before it was possible to finish the opening into it with the bistoury. The surgeon of Pavia thus obviated that defect. His catheter was only grooved to within a few lines of the end which forms its beak, which is olive shaped. The groove moreover is very large, and strongly excavated so as to leave a furrow on either side of the stylet, deep enough to slide the beak of a bistoury along. The piercing stem destined to pass through it, quits it by degrees, and passes out two or three lines below the head, which thus remains in the bladder and cannot escape in following the stylet. Scarpa says, besides, that its edges can always be felt through the bladder with the nail, and that the bistoury passing on one side of the dard, may be carried into it without danger.

The *sonde* of M. Belmas is also a very ingenious contrivance, but is so very complicated, that what it has fundamental about, will not be adopted. Other directors have besides been proposed at different periods. Cleland, for instance, contrived a sound in the last century, which bifurcated like forceps when introduced into the bladder, and thus rendered the walls of the organ more or less tense. Kulm and Heritier, &c. produced nothing better, and the very complex apparatus which within a few years M. Rouget endeavored to bring into use, the object of which was to pierce at one stroke the entire thickness of the bladder and abdominal parietes, is no longer worthy of being mentioned.

The question is, to know whether the only object in the directing instrument shall be to make the organ tense and prevent its collapsing, or else, whether it shall at the same time puncture the reservoir from within outwards, so as to furnish a more certain guide to the bistoury which is to complete the incision.

If the first of these ends is proposed, a common catheter will answer all the surgeon's expectations; if the second, the sonde a dard, the original or that modified by Scarpa, leaves us in truth nothing to desire.

The use of directors, however, is not the only change which has been made in performing hypogastric cutting. Several surgeons have advised that an additional incision should be made *beneath the pubis*. This process had been performed by Sermes, a dutch surgeon, who was on account of it prosecuted by the law and defamed by envy; it was then reduced to simple puncture, and then in some measure assimulated to lateralized cutting. Sermes recommended it as a means of introducing the suspensor sound. Pallucci punctured the same part with a trocar, and left a canula in the wound.

Deschamps thought that the puncture should be made through the rectum, so that the instrument, armed with its dart, might pass in. After all it is to brother Come that this supplementary incision owes all the popularity which it once enjoyed. This lithotomist, who commenced his operation with it, cut the membranous and partly the prostatic portion of the urethra upon a grooved staff, and then used this wound to pass his *sonde a dard* into the bladder. After the operation, a thick and short canula was left in the wound, which by giving vent to the urine was to prevent it from rising up into the hypogastrium. The arguments and success of F. Come for a while deceived the profession as to the value of this incision; but very soon men began to ask themselves if the high apparatus really derived any advantages from this incision, or whether it was not the cause of a dangerous complication. It was easy to prove, 1st, that a wound in perineo in nowise prevented the urine from rising into the wound in the epigastrium; 2d, that it was not indispensable for introducing the *sonde a dard*; and 3d, that it must combine all the dangers of perineal cutting with those of the hypogastric method also. So, Scarpa in 1808, and Dupuytren in 1812, endeavored to suppress the modification of F. Come, and to demonstrate that it was quite as easy to operate with the instrument invented by the latter, when carried into the bladder through the urethra as when introduced by the perineum. The routine of the Feuillant monk* continued to be adopted, when Mr. Home departing from the track twice performed hypogastric cutting in 1819 and 1820 upon the principles laid down in the essay of M. Dupuytren. Some years after, M. Souberbielle himself abandoned the precepts of his grandfather, which he has never followed since 1825; so that this is now a settled question upon which it is no longer necessary to dwell.

§ 3. *The Method of Operation.*

Notwithstanding their points of difference, the procedures which have now passed us in review possess features which are common to them all. These rules relate either to the position of the patient or to the incision of the tissues, or to the means of carrying off the urine, and of dressing the wound after the operation.

1. *Position of the Patient.*—It should be similar to that recommended in the operation for hernia, with this distinction however, that it is proper to raise the pelvis a little. If the legs are allowed to hang over the table or the bed they will put the abdominal muscles very much upon the stretch and cause several inconveniences in this way. Flexion of them, as in parietal lithotomy, would interfere with the motions of the operator. The operation might in fact be done on a bed; but a narrow table, of proper height, makes the position of every patient infinitely more convenient.

Injection. Placing the Conductor.—When we mean to follow the plan of injecting the bladder and effect its distention by means of liquids, we must begin by introducing a common catheter into the urethra. To the open end of this, the pipe of a syringe filled with warm water is then fixed. The process of injection is very slow, so as to pour into the bladder as much fluid only as the patient can bear without feeling too much pain. At

* A friar of the reformation of St. Barnard.—Trans.

the present day no one would think of using the ureter of an ox, the trachea of a turkey, or a copper staff, as advised by Douglas, Cheselden, Middleton and Solingen, to connect the syringe with the catheter, so as to avoid all kinds of motion or shaking. The injection being finished, an assistant is immediately requested to compress the urethra, to prevent the fluid from escaping too soon. Many patients it is true, do not require this caution; but as this is not the case with some others, prudence forbids our dispensing with it. The fingers are much better than any of the compressors invented by Nuck, Winslow, and others.

Incision through the external parts.—The surgeon proceeds to open the wall of the hypogastrium, standing on the right side of the patient, rather than between his legs, as M. Belmas recommends. It would be childish to argue about the superior advantages of this over the other bistoury at this period of the operation. It matters little whether it be a razor, a straight or a convex bistoury, or a small knife, so that it be only very sharp; except, that as in the sequel the straight bistoury is the most convenient, I think that as a general rule it deserves the preference. You hold it in the first position, *i. e.* like a table knife; and after having stretched the parts with the left hand, you divide the parts from above downwards, for a length of at least three or four inches, 1st, the integuments, 2d, the adipose cellular layer, and so come down to the aponeurosis. Whatever Zang may say this incision had better be long than short, and though contrary to the advice of Winslow there is an advantage in carrying it down on the fore part of the symphysis for half an inch below the upper edge of the pubis.

All surgeons do not perform the division of the aponeurosis in the same way. Some do it with the instrument they have all along used; others, among whom is Scarpa, prefer that, after having cut it completely down, a director should be passed beneath it, which may insinuate itself between the peritoneum and the abdominal wall from below upwards, so that on it a bistoury may be directed in the like direction to cut the entire thickness of the fasciæ.

For this purpose F. Come employed an instrument which ended by a triangular point on one side, by a handle cut in facets on the other side, enclosing a cutting blade which has a flat plate at its free extremity, and which opens from haft to point, consequently in an opposite direction to the sheathed lithotome. This trocar is plunged from before backwards, and from above downwards, until it gets between the symphysis and anterior wall of the bladder. The surgeon then with his right hand fixes the stem against the bone; seizes the flat plate with the thumb and forefinger of the left hand; carries this plate from the handle from below upwards, and divides in the same direction the linea alba and other tissues with which the blade meets in its passage. Having withdrawn the trocar, F. Come substitutes in its place a bistoury ending in an olive-shaped point, solid in the handle and cutting on its concavity; cuts from below upwards, holding this second instrument in his right hand directed by the fingers of the left hand, all the laminæ which may at first have escaped, and takes care to pass the knob into the bladder, the peritoneum, and even the deep surface of the aponeuroses.

At first sight the method of F. Come seems more dangerous than any other. It is terrifying to see his trocar-bistoury acting from below upwards and from before backwards, without any guide to control its direction. However as it

cuts rather by pressing than by sawing, and as its blade when open as far as possible represents a line drawn very obliquely from the integuments to the bladder, it is rare for the peritoneum to be really injured. The only reasonable objection which can be raised against it is that it is not indispensable, and that a person accustomed to perform the great operations in surgery will do it just as surely with a common bistoury. With this view, I do not consider the improvement made in the instrument by M. Belmas as of any great value; it consists in making it concave on the back and convex on the cutting edge. As to the probe-pointed bistoury of the inventor, I have, I dare say a thousand times substituted the common probe-pointed bistoury for it in the hands of pupils operating upon the dead body, and never yet felt the want of an instrument specially for the purpose. Almost all surgeons at the present day, advise us to cut directly down upon the median line; however, returning to the recommendations of certain authors, M. Baudens has recently exerted himself to prove that it is better to cut outside of this fibrous line, because the wound, if made between it and the inner edge of the rectus muscle, will be less difficult to enlarge and it will be more easy to part its lips to come upon the fore part of the bladder. This is a piece of advice again which may be followed or neglected without any unpleasant result. The thing needful is to get between the two sterno-pubic muscles, and not to go across their fibres. After this, whether the linea alba remain untouched on one side, or be actually split into two equal parts, need cause us no uneasiness. Besides which it is generally so difficult to detect it beneath the adipose tissue, that the knife is guided almost constantly by data approximating to that direction in which it usually exists. I may add that if it is better not to go through fleshy fibres, it is not from any fear of incising them, but because of the greater depth to be gone through before we come to the sub-peritoneal cellular tissue, and because also, the serous membrane is found more closely applied to the thick wall of the hypogastrium outside of and not upon the median line. The straight bistoury of the common kind, held like a table knife or like a writing pen, is as good as any other to divide the skin, fatty layer and aponeurosis from above downwards and alternately.

When the surgeon comes to this aponeurosis he must proceed with great slowness, and divide it layer by layer, pressing more strongly upon the part nearest the pubis than upon the upper end of the wound. As we always come upon the pubio-vesical triangle on the median line, and with a little attention we may always tell when we have reached it, the peritoneum runs in truth no risk at this part of the operation. Supposing that very close adhesions superiorly should prevent us from opening the aponeurosis sufficiently deep in this direction, we must then take a probe-pointed instead of a straight bistoury. Its point is to be carried into the triangle just indicated above the pubis, against which the operator may for greater security rest the back of the knife with his right hand; the left thumb and forefinger take hold of the blade by its sides to pass it from below upwards, and make its probe point slide over the anterior surface of the bladder, or the inferior portion of the peritoneum itself, for an extent of about two inches between these parts and the deep surface of the linea alba.

It is very true that the bladder may be opened with less danger below than higher up, but in the first case the cutting edge of the bistoury must be

turned towards the umbilicus, by which the peritoneum is considerably endangered; whilst in the other we are pretty sure to avoid it altogether if it is not injured at starting.

The idea which Middleton and some others had of looking for the urachus or the central spot which separates this ligament from the pubis, is a useless one. The important point, and the only one, is to come upon the anterior wall of the bladder at a spot not covered by peritoneum. This is to be punctured with the straight bistoury, or with the small concave knife of Cheselden, or Rousset, carried along the nail of the left forefinger and inclined from above downwards. As it is withdrawn care must be taken rapidly to enlarge the wound, so as to introduce some suspensory instrument immediately into the bladder. The index finger crooked upwards like a hook, will at first do instead of it. If afterwards the walls of the abdomen seem very thick, and make it difficult to get down to the urinary bladder, we may adopt Zang's advice and pull the edges asunder by means of small blunt hooks. The curved finger serves anew to direct the bistoury made use of to enlarge the wound in the bladder, and extend it towards the neck for an inch or more according to the supposed volume of the stone. In common cases the same bistoury, that is, the straight bistoury, is here also sufficient, and is even better than a probe-pointed one, inasmuch as that its point when being withdrawn better divides the tissues. If the *embonpoint* of the person should make it difficult to employ it, it might well be superseded by Pott's concave bistoury, which would do away altogether with the concave instrument contrived by the ancients. As to curved edged scissors, I know of no circumstances in which they can deserve a preference. If the finger takes up too much room at the time of introducing the forceps, or of the extraction of the stone; if we are afraid of getting it injured during this latter manipulation, as Deschamps instances an example, whether it belong to the surgeon or the assistant it had better be removed and a proper instrument substituted for it. The blunt hook of F. Come is perfectly proper; but the sort of gorget with a handle bent at nearly a right angle near the end, which was constructed by M. Belmas, would evidently do better. Indeed this suspensor, the groove of which should look downwards, would keep open the lips of the wound whilst it constituted an excellent director, without giving any inconvenience whatever to the inner surface of the bladder or the artificial opening. Nothing now remains but to extract the stone. But before I proceed to this step in the operation, I shall stop to consider those necessary when the *sonde a dard* is used instead of injections.

Use of the Director.—When a director is employed, it had better be introduced before the hypogastrium is opened than afterwards; first, because its beak will then serve as a guide in some cases above the pubis; and secondly, because the patient will suffer more from its subsequent introduction. I suppose now that it is the *sonde a dard,* which we are to employ. It is introduced like a common staff, its concavity pushed behind the pubis, and thus its point is tilted up above the superior strait opposite the linea alba. An assistant is directed to hold it in this position, whilst the operator proceeds to divide the integuments and aponeurosis. When the bladder is laid bare, the latter takes the sonde into his own hands again, withdraws it a little to raise its beak from below upwards, rubbing gently against the pubis in such a way

as that the peritoneum may not intervene and form a fold before that point in the wall of the bladder through which the point is to pierce to pass into the wound. The left forefinger passed down to the bottom of the incision, follows its motions, and indicates the degree of elevation and protrusion to which the instrument has attained. Having suitably fixed its position, it is again given to the assistant. The surgeon pinching the sides of its salient extremity then desires the assistant to push out the dard, which passes to a length of from one to several inches; he then, if he fears that it may inconvenience him, unscrews its point. Without displacing the left hand, in the right he takes a bistoury, which according to Scarpa should be convex, but according to Belmas just the reverse, and which however does equally well whether it be the common or the straight; the point of this held like a pen he places in the groove of the dard; passes it along into the bladder, and divides this organ upon the median line from above down, and from before backwards near the neck or prostate gland; draws back the dart into its sheath, and directly introduces his left forefinger into the bladder. The assistant removes the instrument. If the surgeon thinks it necessary to use some artificial suspensor, he sets about the introduction of that which he selects at once; takes the hook or the curved gorget, supposing him to choose it, in his right hand; presents it at the vesical opening in the most suitable direction; raises it when it has entered; slips it, instead of his finger which he withdraws, into the lower angle of the wound, and then gives it in charge to his assistant. Both hands being then free, he can fearlessly explore the inner part of the bladder, and judge of the situation and form of the calculus which is to be extracted as the termination of the operation. This may often be done by the curved finger, the thumb and index finger, or the forefinger and a scoop; in others it demands the use of forceps, which here admit generally of more easy management than they do in sub-pubic lithotomy. The precautions to be attended to in using them are precisely the same, save that more care must now be taken than before to avoid detaching the bladder from the pubis and abdominal parietes, by tearing the lax cellular tissues which connect these parts with one another.

The Dressing.—Cystotomy above the pubis, different from other varieties of operation for stone, has much engaged the attention of surgeons as it respects the dressings which are adapted to it. In the time of Rousset stitching the wound was practised, and has since often been put in execution. Through its assistance it was hoped that urine would be prevented from escaping by the hypogastrium, and causing infiltration outside of the bladder. This suture, which was oftener recommended than adopted, was not understood in the same sense by all authors who ventured to advise it. Solingen, one of its warmest partisans, does not express himself with sufficient clearness for us to understand positively whether he sewed the skin merely, or included in the stitch all the thickness of the lips of the wound. Others have spoken on the subject more categorically. Douglas, for example, thinks that the suture through the integuments will be sufficient, Professor Rossi, on the contrary, maintains that above all things we must endeavor to sew the wall of the bladder itself, and Dr. Gehler asserts, that we should include both in one thread.

The question here stated is a serious one, which can be determined only by experience. Hitherto the cases related, either in favor of or against using

suture scarcely prove any thing. Heister indeed says that Præbisch having performed it upon a patient, the man was soon attacked with such alarming symptoms that he was obliged to cut the stitch and withdraw the threads. But how was this done? What tissues had it penetrated? How far was coaptation perfectly affected? Of all this we know nothing whatever. Yet until we do know it, it is impossible to say whether it is to the stitch or the surgeon that these symptoms which Heister describes are to be attributed. In the year 1825, M. Pinel Grandchamp engaged in some researches upon this subject. He opened and sewed up the bladder in a certain number of dogs, and in this animal the operation so perfectly succeeded, that in no case did the least effusion occur, but immediate adhesion followed in all. Since then M. Amussat has decided in favor of it, and some successful cases have been related in the Journals which were communicated by him to the academy of medicine.

Still it is a method against which numerous and powerful arguments may be urged. And first it is not probable that any one for the future will resort to suture of the integuments alone, nor to that of aponeurosis or muscles. It in fact closes the passage of urine, but does not prevent them from escaping from the bladder; compelling this fluid, in other words, to effuse itself in the pelvis. As to suture of the wound in the bladder it is far from being always easy. Did the urinary bladder remain distended to the close, or did the incision in its anterior wall not go below the upper edge of the symphysis, and were the hypogastrium always thin, we might indeed, I think, look for success from it. But since the incision extends towards the prostate, how can we be sure that we leave no void between its edges in its lowest part? And if they are not in perfect coaptation who does not perceive that an oozing of urine will infallibly occur, which fluid will be effused between the organs it is intended to close, and more or less solid tissues which surround it. Lastly, it is also to be apprehended that the stitches themselves by enlarging will allow passage to the urine, and some regard must be had to the pain which they occasion and to the length which they give to the time of the operation. It is a method, therefore, which is of advantage only in cases where it is possible to coaptate with perfect nicity the incision in the bladder in its entire extent; but it also demands that the furrier's suture, the only one which can reasonably be adopted, should be capable of being performed without tearing too much, or disturbing too extensively the circumjacent cellular tissue. As it is necessary to leave a portion of the thread to hang out of the wound, which of itself would not fail to prove a cause of abscess and infiltration, I think upon the whole that in hypogastric cutting, suture in any form ought to be rejected.

The indication, nevertheless, which the introduction of stitches is intended to answer, is one of a very important kind; and has therefore unceasingly engaged attention. After many trials it was thought that to leave a catheter in the wound would be a very sure way of carrying off the urine outwardly. Solingen seems to have been one of the first who conceived this idea. It is not yet quite certain whether the leather catheter of which he speaks was not introduced per urethram, and not into the hypogastrium; but a German surgeon, Huermann, leaves no doubt on the subject, for Sprengle distinctly states that he much lauded the usefulness of a *catheter buried in the incision* after

the operation. An operation performed in the month of December 1818, and published in the following year in Dublin by Mr. Kirby, shows that this gentleman had confidence in Huermann's practice, for having performed the nigh apparatus he left a tube in the wound. In France, M. Amussat, who thought the idea original with himself, expressed himself strongly in its favor. The tube he uses is two or three inches long, as thick as a finger, and terminates in the bladder by a swelled extremity perforated with holes like the spout of a watering pot. When introduced he closes the cut directly above and below, either by stitches or adhesive straps. Unhappily the hopes by some entertained of this practice have not been realized. Mr. Kirby after four days perceived the urine passing out between the canula and the edges of the wound. In some operations performed by M. Amussat himself, the same thing happened. Afterwards the case of a patient at the Hospital St. Louis, in whom the tube did not hinder even if it were the cause, the formation of an urinary abscess. Moreover it is impossible to conceal one's surprise that M. Amussat should extol such a method, and ascribe such vast advantages to it, when he confesses himself that he has lost three patients out of twelve; while more than a century ago Sermes lost only one in sixteen, and Thornhill two out of thirteen. It is a law of the human organization that an enclosed foreign body, pressing equally on every side in the centre of a wound, is soon at liberty, and allows fluids to escape upon its external surface. A canula therefore cannot prevent urinal infiltration; and as its presence must be attended with inconvenience it well deserves the neglect in to which it has fallen. With so much reluctance have surgeons abandoned this idea, that they have turned their thoughts into another channel in order to effect the object—that of carrying off the urine externally as rapidly as it is furnished by the ureters.

For this purpose M. Segales has proposed that a skein of cotton should be enclosed in a gumelastic catheter; that one end of this skein should be placed in the bladder, and the other end be left hanging out of the urethra to act as a filter; doubtless forgetting that even admitting its efficacy, the thing should answer exactly the same end though it were placed in the wound in the hypogastrium. M. Souberbielle has recommended the use of a breath syphon, made of a thick flexible catheter placed in the urethra, and of a long gum-elastic stem, which is plunged into a vase placed beneath the level on which the patient lies. To fulfill the same indication, M. Heurteloup has invented the "uretro-cystic tube," which in a measure combines the plans of MM. Segales and Amussat, as it is composed of a hollow stem which passes out of the wound, and a similar one which fills the urethra, so that the urine must enter by lateral apertures which it meets with near the neck of the bladder, and of course escape by one end or the other. Experience has not yet declared in favor of either of these resources: and when we reflect upon the irritation to which they subject the urethra, the bladder, or the wound; when it is noticed that in the horizontal posture assumed by the patient after the operation, the level of the artificial wound is sometimes lower than that in the urethra opposite the suspensory ligament of the penis, it is really difficult to coincide with the inventors in the advantages which they promise themselves. One thing to which enough attention has not been paid, is the *reason* of this almost insuperable tendency which the urine has to

flow over the pubis. It seems, at first glance, that it must ascend contrary to gravity. But on a closer inspection, this does not appear to be the case. In fact, it is rare for the vesical incision in hypogastric cutting not to descend nearly as low as the prostate, and at least to the middle of the height of the symphysis. This granted, it is easy to assure oneself that the urethra when it escapes from under the arch rises to as great a height at least, even when a man stands in an upright position; and that lying down or in a horizontal posture, the urine certainly has further to go to get there than to reach the lower angle of the wound. It is consequently all labor lost which is spent in the attempt to use similar measures. Most practitioners limit themselves to the use of skeins of cotton or strips of linen, of which one end rests in the bladder to act as a filter. Pledgets of lint and dried roots of plants would do more harm than good. It is not certain that the simple strip of raveled linen, used by F. Come has any solid advantages. Certainly if it be recurred to it ought not to be steeped in oil, nor any sort of grease; and as blood, pus, &c. which it imbibes speedily, before long destroy its permeability, very little benefit can be expected from it. The only real necessity which the surgeon feels is to prevent the parts as they approximate too soon towards the integuments from offering any impediment to the flow of fluids coming from the bladder. If, during the first twenty-four hours, we were to put nothing between the lips of the wound, some danger might be apprehended in this respect; but later than this, when the morbific process has commenced the perviousness of the tissues is so much lessened that we rely upon the organism for all that concerns cicatrization and the exit of urine.

The position of the patient after cutting by the high apparatus need not be continued as long as in perineal lithotomy. He may turn to one side and to the other, and even sit; at the present time no one would advise that he should lie constantly on his abdomen, as was the idea of some one in the last century. I may add, that when the time for the first symptoms to occur is past, at the end of five, six, or eight days, and no accidents have happened, and no fever is present, the patient may leave his bed and soon after walk about without risk, and on the contrary, with advantage; for a vertical posture or a sitting one indisputably favors the passage of urine through the natural passage.

Unfavorable Occurrences.—Hemorrhage, to prevent which so much care has been taken in perineal lithotomy, and against which it should seem that cutting through the hypogastrium must offer security, has notwithstanding several times been known to follow this latter operation. Pye has recorded a remarkable example of it. Another exists among the cases of Thornhill, as related by Middleton; a third in the works of M. Belmas; and I understand that last year it had nearly proved fatal to a patient operated on by M. Souberbielle. Thus far surgeons have not specified the particular vessel from which it issues. Some have thought that it depended on the subcutaneous veins or arteries being larger than usual. Others have supposed arterial anomalies in the thickness of the linen alba, or in the *fascia propria.* It has also been attributed to sanguineous exhalation from the inner surface of the bladder. All these are merely more or less probable suppositions; not facts really demonstrable. Anatomy would soon explain the occurrence if practice had been more intent on determining its seat. It might so happen, for

example, that the arteries which ascend naturally over the sides of the bladder and cross one another above its neck, might form a loup large enough to produce it. It would be equally possible that the dorsal arteries of the penis, coming directly from the hypogastric and passing on the sides of or above the prostate, as described by Burns, Senn, Shaw, &c. might be divided if the incision extended very far down.

Be this as it may, the event is an uncommon one, and art possesses several means of conquering it with facility. If it occurs during the performance of the operation, all the divided tissues being beneath the eye, it may be possible to lay bare the open artery, to seize it with forceps of sufficient length, and to twist or tie it. Under opposite circumstances, that is to say, when hemorrhage does not come on until after the dressings are applied, we may begin by keeping them moist with cold water for several hours, unless the quantity lost is likely to exhaust the patient. In that case we must remove the dressings, and look for the vessel. If it can not be got at or its situation be discovered, tampons soaked in the eau de Rabel, or some other styptic liquid, should be passed down even within the bladder itself; or we might pass into it a roll of lint of some size, tied in the middle by a long double thread, capable of receiving between its two ends a second tampon, on which they should be fastened in front of the wound in such a way as to compress the tissues sufficiently from behind forwards. We should previously remove all the coagula contained in the bladder, and wash out this sac freely by injections of water. Middleton says, that the prostate may be wounded when the incision is too deep, which is true; and besides, that this wound often gives rise to a dangerous ulcer, which appears to me to be wholly unfounded. He also speaks of injury done to the symphysis pubis, and the consequences which may result; but at this day no one troubles himself about such lesions, which in fact are not worth being pointed out.

Abscess.—The formation of abscesses round about the bladder is one of the occurrences most to be apprehended. Douglas, Cheselden, and almost all authors who since then have treated of hypogastric cutting, have mentioned them. There are two orders of them which we must be careful not to confound. The one depends upon the infiltration of a greater or less quantity of urine between the bladder and surrounding tissues; the other is the mere result of inflammation in the cellular tissue of the pelvis.

It is easy to see that if the operation has been attended with a good deal of detachment and extensive laceration, urine will easily escape into the cellular tissue, instead of escaping externally, and we all know how dangerous are the inflammations caused by the irritation of urine. When no detachment has occurred, infiltration is very rarely observed. Indeed, after a few hours, the lips of the wound have lost much of their porousness, and fluid goes through them without getting into their meshes by weight or capillary attraction, as might have been feared; so that unless an excavation, a cul-de-sac allows of its accumulation in it outside of the bladder, it is not common for its escape through the opening in the hypogastrium to be troublesome after the first day. Unless the reaction be excessive the parts become very red; unless there be very high fever with a strong full pulse, sanguineous evacuation, either general or by leeches, is rarely required in such cases. Urine spreading by transudation into the lamellar tissue, is a death-bearing

fluid. If there is anything that can stay its ravages, it is only incisions in large numbers, made deep into all the infiltrated parts and their neighborhood as soon as possible. Unhappily this means cannot always reach the seat of the evil; but of course they must be always performed wherever they can be made with safety. The wounds are then dressed immediately, at least until the eliminatory inflammation shows itself, with camphorated brandy, decoction of kino, or some of the chloruretted solutions. Common abscess, without urinal infiltration, is less frequent; and depends almost always upon the manner in which the operation has been performed.

When the bladder has been opened by the dard or bistoury, it is so easy for the forefinger to push it back instead of entering its cavity, that it often detaches it entirely from the back of the pubis; and creates here a large pouch, which almost necessarily causes violent phlogosis followed by profuse suppuration. I have no doubt that this has happened in most of those cases in which it has been asserted by operators that the bladder consisted of two cavities, the one anterior, in which nothing was found, and a posterior one which contained the calculus. Here an antiphlogistic treatment is necessary when the patient is able to support it; and that this serious affection is not further complicated by urinal infiltration the fluid must be evacuated, as freely as possible and we must not fear to multiply incisions or to extend their length in different directions.

Injury of the Peritoneum.—The injury most spoken of in hypogastric cutting is incontestibly that of the peritoneum. Nearly all authors have considered it as one of the most alarming, and some as being invariably fatal. Without wishing to extenuate its danger, I do think that the risk has been singularly exaggerated nevertheless. Certainly it alone is not very much to be feared. It is dangerous rather from allowing the urine to pass into the abdomen. Now the operation is no sooner ended than the bladder collapses, retracts, and gathers itself into a heap behind the symphysis pubis. The wound in its wall then ceases to coincide with that in its serous tunic. Consequently the urine cannot in truth escape in that way and reach the abdominal cavity. What proves this much better than argument, is the fact that the peritoneum has often been wounded without any serious accident resulting, and that in those who have died with this injury about them, causes of death perfectly unconnected with its occurrence have been discovered. One of Douglas's patients had the peritoneum opened, and yet recovered as well as if nothing had happened. One of Thornhill's was equally fortunate. It is even said of another who likewise recovered, that the intestines came through the wound, and their reduction became necessary. This accident has been met with by F. Come and M. Souberbielle, who neither of them seem to fear it. A woman, who was operated on at Tours, in 1828, by M. Crozat, had also a very large opening in the peritoneum; nevertheless she perfectly recovered. They say that last year a celebrated operator was not equally lucky; but if the statement given of the operation is a faithful one, a pledget was introduced into the interor of the serous cavity instead of into the bladder; and therefore this case can be considered as no criterion of the danger of cutting the peritoneum. It would, I think, be adding greatly to its danger when it does happen to sow its edges, as McGill recommends, or to stitch up the whole solution of continuity, at least in its upper part, as Douglas advises us

to do. A pledget of lint or a strip of linen placed quite below the cut, penetrating even into the bladder is all that in such a case is really required. A strip of diachylon plaster may be put on above, and the patient should be prohibited from making any motion capable of pusning the viscera towards the peritoneal aperture.

B. *Of Cutting for Stone in the Female.*

Women are much less liable to calculous affections than men, and get rid of them much more easily. The urethra in them is short, straight, and wide, so that small calculi pass through it with the greatest ease, and seldom grow to any size within the urethra. However, they are sometimes observed, and then it becomes necessary to have recourse to the same means which are employed in the other sex for their extraction. Lithotomy in women is equally performed by the high and the low apparatus. The first of these methods, as it is subjected to the same rules in every respect as in man, requires from us no description; not so the second, in which we shall perceive that recto-vesical cutting is superseded by the vagino-veiscal and lateralized cutting by incision of the urethra.

Art. 1.—*Anatomical Remarks.*

The bony strait, which in females is much wider and more shallow, offers in other respects the same anomalies, the same peculiarities, gives insertion and attachment to the same muscles and aponeuroses as in the male. The soft parts alone are not similarly distributed. The vagina, situated between the rectum and the bladder, is the cause of most of the differences observed in it. It is this part, which renders the study of the posterior aponeurosis and of the intestine, and likewise of the perineum properly so called, almost useless, as to whatever concerns lithotomy in the female; which makes the horizontal aponeurosis almost wanting; and which does away almost with the free triangular space between the ischio, and bulbo cavernosi muscles, so that our remarks must be confined wholly, or nearly so, to the urethra, uretro vaginal septum, and the tissues which immediately connect and surround them. The urethra is from twelve to fifteen lines in length; it is wider backwards than in front by a diameter of two to three lines; superiorly it is slightly concave, and is neither surrounded by prostate gland, bulb, or by a spongy portion, so that in some manner it is reduced to the membranous portion of the male. Backwards it is adherent in its whole extent along the median line to the wall of the vagina, and corresponds to the longitudinal ridge to the anterior median column of this canal, which interposes between their interiors a thickness of three or four lines. As the vagina is much wider, it naturally extends on either side beyond the urethra, and seems even in certain cases to turn up, laterally, as if to embrace its concavity; from whence it follows, that a cutting instrument would infallibly wound it, which should pass from the duct of urine obliquely outwards and downwards. It is conceivable moreover that this wound would be the more likely, according to the width of the vulvo uterine canal, and to the number of labors greater or less had by the woman, consequently greater in the mar-

ried woman than in virgins and children. The bas-fond, or vesical trigonal space, is like the urethra connected with the anterior face of the vagina; but instead of quitting it as in man it quits the rectum, this portion of the bladder ascends almost up to the body of the wound before the peritoneal layer is reflected over it; a very great advantage, insomuch as that with such an arrangement of parts we may fearlessly divide the whole vesico-vaginal septum from the os tinca down to the urethra. It must moreover be remarked, that as we need have no concern for vesiculæ seminales, vasa deferentia, or ejaculatory canals, the surgeon is much freer to search for the stone, and in fact has nothing to fear but wounding the ureters, which are placed sufficiently outwards to be almost always easily avoided.

The female urethra, inspected upon its anterior surface, does not differ as much from that of the male; still it is covered by the prostatic frenum, no muscle, and has only the loose cellular tissue which separates it from the pubis, the small veins which environ it, and the dense filamentous tissue which attaches it beneath the arch in common with the other. This tissue, by the bye, is sufficiently remarkable. It is dense, elastic, and possesses a certain degree of porousness; presenting some of the characters of the yellow fibrous tissue, and forming a thick stratum several lines thick, continuous in front, behind, and also below, with the sub-pubic ligament, and also with the inferior face of the clitoris which corresponds to the end of the symphysis. The labia minora, which coming from the corpora cavernosa, seem to lose themselves obliquely outwards on the inner surface of the larger ones two or three inches lower down, have between them a triangular separation, whose summit is represented by a small excavation which divides the urethra from the clitoris, and through which a bistoury can pass directly into the bladder. Following their direction and inner edge, lateralized cutting after the method of frere Jacques may be performed. The meatus urinarius may be distinguished amid all its parts by the little tumor which it forms just above the opening into the vagina. The arteries are so small in the female perineum as to scarcely deserve the surgeon's attention. The transverse and that of the bulb are reduced to small twigs; the pudic itself, very small posteriorly, is extremely delicate long before it terminates upon the clitoris.

Art. 2.—Examination of the Methods of Cutting.

By some surgeons it has been said, that all lithotome procedures applicable to man might be equally practised on the woman. This assertion is certainly erroneous. The apparatus major for one will never be performed; and as much may almost be said of bilateral cutting, at least if done by the lower surface of the urethra. We have then remaining the lateralized operation, and that by the apparatus minor and vaginal cutting.

§ 1. *Old Methods.*

a. *Lateralized method*, better called *Lateral cutting*.—The ancient Greeks, Arabians, and surgeons of the middle ages, performed lateral cutting in women as in men. Whilst staffs were not in use, they brought down the calculus

into the neck of the bladder, and held it there by two fingers in the vagina, or if the patient was a virgin in the rectum, curved like hooks. They then incised from the integuments towards the bladder all the tissues laying over the stone, in an oblique direction from above downwards and outwardly from within. Brother Jacques altered the process merely by using a staff to make the parts tense, whereby he was enabled to avoid seeking the stone by the fingers in the rectum or vagina. The trials made by this monk before Marechal and DeMery, having shown, as a correct anatomical knowledge of parts might have led us to suppose, that the vagina was always wounded and that the rectum could easily be injured, it was speedily abandoned, so that at present it is neither recommended by any one nor performed.

b. *Method of Celsus or of M. Lisfranc.*—Celsus expresses himself so obscurely, and with such little minuteness about cutting in the female, that it is difficult to know accurately what he meant by these words; "mulieri vero inter urinæ iter et os pubis incidendum est sic ut utroque loco plaga transversa sit." Some, M. Desruelles among others, think that in the days of this author an incision was made either transverse or semilunar between the meatus urinarius and the root of the clitoris, and that through that they went in search of the stone, as in men is done between the scrotum and anus. But as has been remarked by M. Coster, it is not impossible that Celsus had in his mind the incision into the urethra itself instead of that which I have detailed. It is not clear, either, how surgeons contrived to make the stone bulge out above the urethra, and it is difficult in such a case to agree literally to M. Desruelles's version.

From this it would appear that M. Lisfranc's operation, which consists in entering at the vestibule, is not a reproduction from the ancients. It was supported by M. Meresse, in 1823, at Montpelier, and explained at length in the Archives for the year 1824, and is done in the following way.

A staff is first passed into the bladder, in such a way as that its groove or convexity should be turned upwards and forwards, instead of resting as in man downwards and backwards. Seated before the perineum, provided with a straight bistoury the surgeon makes an incision of a semilunar shape between the clitoris and external orifice of the bladder which skirts the inner surface of the labia minora, has about the same curve as the pubic arch at its upper half, and besides includes the vagina in its concavity. He then divides alternately, and layer by layer, all the tissues which separate the vestibulum from the interior of the pelvis; comes down upon the anterior surface of the bladder, at the urethra with the neck of the organ; strikes on the staff; cuts upon its groove, carries the incision further up turning the edge of the bistoury in that direction and downwards so as to divide longitudinally the posterior part of the urethra, or else cut across the reservoir of urine for a length of twelve or fifteen lines. As the adhesions of the urethra have all been destroyed by the anterior incision, it becomes easy to press down this canal and crowd it down to the lower wall of the vagina, and so create a large space in the upper part of the pubic arch, of which I have many times satisfied myself upon the dead body. Nevertheless this is a method in many other respects so faulty that we may henceforward assert that it will never be adopted. Do it as you will the stone must always pass through the narrowest point in the pelvic outline. The bladder longitudinally opened can never give passage to calculi of much

size. If it were divided cross-wise, the inevitable separation of the lips of its wound in a place so encircled with cellular tissue, would probably not fail to give rise to infiltrations and abscesses of the alarming nature described when speaking of hypogastric cutting. We should either have to fear an urinary fistula, or incontinence of urine.

c. *Vesico-vaginal cutting.*—The idea of extracting calculi through the vagina goes back at least to the time of Rousset, as this author states that he removed in this way eleven from a woman in whom the bladder projected at the vulva. Fabricius Hildanus followed the example of Rousset, in a case in which the vesico-vaginal septum was partially perforated by the stone; then afterwards in another calculus female, whose bladder had been lacerated during delivery. Ruysch also performed this operation, and removed forty-two stones from the same female, in whom there was inversion of the vagina. Tolet did the same under circumstances nearly similar. In 1740, Dr. Gooch encountered a patient in whom the vesico-vaginal wall had been ulcerated by inflammation, into which he cut to remove a stone which weighed three or four ounces. M. Faure of Limoges transmitted to the faculty at Paris in 1810 a piece of wood which he had removed from the bladder of a young girl by an incision through the vagina. M. Clemot, a surgeon of Rochfort, performed it for the first time in 1814, upon a young female aged twenty-one; and soon after repeated it upon another patient. Since then he has a third time had recourse to it. At a rather later period M. Flaubert of Rouen, performed the same procedure to extract a needle and a pin which had become the nucleus of a stone in a child eleven years old. In 1816, he operated on a female thirty-three years old, who had a calculus as big as a nut; afterwards upon another one aged forty, in whom the stone was nearly as large as a billiard ball. On the 10th Dec. 1818, he did it a fourth time upon a woman twenty-one years of age and removed a stone as big as a large nut. M. Rigal de Gaillac, also operated per vaginam, in 1814, upon a woman forty years old in whom the stone weighed two ounces and a half. The same surgeon performed it once several years previously, in a woman thirty-eight years of age who for eight years had had a considerable stone. A recent example has been recorded by M. Lavielle; and M. Rigal, jr. has lately communicated another to the Academy. So that we have now about twenty cases of vesico-vaginal cutting, not including two attributed by Dr. Gooch to surgeons of his country, about which he gives no particulars.

The method of Operation.—Many of those who have performed this operation, are silent as to the procedures which they adopted. F. Hildanus who first formally proposed it, advised that a scoop of very small calibre should be carried into the bladder through the urethra to embrace the stone in its spoon and press it down towards the vagina, drawing it to the neck of the bladder, so that the surgeon, cutting down on the projection which it makes in the vulvo-uterine canal, may extract the stone by this passage. The procedure of Mery, which consists in substituting for the scoop recommended by Fabricius, a common staff, so as to divide the vesico-vaginal partition upon its groove, must forever have done away with the adoption of that of the Swiss surgeon. Indeed it is this operation, modified, which modern surgeons pursue; some by the addition of a gorget, by the outer end of which they depress the vaginal posterior wall, whilst the other end butts against the

staff in front of the cervix uteri: others like M. Flaubert, for instance, confining themselves to carrying in the bistoury flatwise on the right forefinger, then turning its edge upwards and cutting the septum from before backward or from behind forwards to a greater or less distance from the meatus urinarius.

Position of the Patient.—It is undoubtedly possible by placing the woman in the position for ordinary lithotomy, to attain the proposed end. However, I think that if she lies upon the abdomen with the thighs and legs flexed, it would be easier still to perform the necessary incisions.

The instruments necessary are merely a staff, a Marchettis's gorget, a straight bistoury and forceps. The staff is first introduced, and its handle elevated towards the pubis, so as to depress the bas-fond of the bladder upon the median line. An assistant is entrusted with keeping it in the situation. The gorget introduced to the bottom of the vagina is given to a second assistant, who depresses the handle, being careful to make it a fulcrum for the staff at its other extremity, and that its groove should look upwards and forwards when the woman lies upon her back; and backward, on the contrary, if she is placed on her abdomen. The surgeon separates the labia majora with the thumb and first fingers of his left hand: takes his bistoury, holding it like a pen: carries its point behind the urethra, that is to say to a depth of an inch into the vagina at least; strikes it into the groove of the staff, slips it along upon this instrument to an extent of eight or ten lines or more if necessary, and ends his incision by lowering the knife a little to make it fall into the groove of the gorget.

It may also be held in the second position: *i. e.* the handle in the hollow of the hand, and the cutting edge towards the bladder, so that its point may enter as deeply as may be desired to divide the septum from behind forwards, still upon the groove of the staff. These two modes differ so little in their definite result, and in the ease with which they are effected, that we must leave the preference of one over the other to the taste of the operator. There can be no doubt, likewise, that the surgeon may himself hold the staff in his left, whilst he makes the incision with his right hand, as was done by M. Flaubert, or else as M. Clemot recommends he may take charge of the gorget instead, so as not to be embarrassed by his assistant whilst dividing the septum; in truth, we may do without the gorget altogether, in imitation of the surgeon of Rouen, and carry in the bistoury, covered by the inside of the forefinger into the vagina; so as to open the bladder without any other assistance than that of the persons who attend to the patient. Yet it cannot be denied that the operator who has both hands at liberty, will be more at his ease in performing his principal incision, and that the gorget has the advantage of rendering tense and exposing the parts which are to be divided; only it would be well that this instrument should have a handle bent at an angle, the groove ending in a cul-de-sac. There is this inconvenience in the procedure of M. Flaubert, of beginning the incision some lines behind the meatus urinarius, so as to include a greater or less extent of inner wall of the urethra: first, that it in nowise assists the exit of the stone, and then that it renders cicatrization of the wound long and difficult. It is better then to follow MM. Clemot, Rigal, and others, and to begin it only at the apex of the trigone vesicale if we cut from before backwards, or to terminate it at that point if we prefer incising from behind forwards. The vagina being four or five inches in length, we have

still by this procedure an extent of two inches which may be divided without any danger. Besides as these tissues enjoy a considerable distensibility, it is useless to make a larger aperture than the presumed size of the stone would require.

Extraction of the Stone.—The incision being made, the staff is withdrawn. If the stone do not of itself offer at the wound or fall spontaneously into the vagina as sometimes happens, the operator proceeds at once to investigate its situation and character by the assistance of his left forefinger; and then extracts it with proper forceps pursuant to the rules previously established. When the stone is very bulky, and we are operating on a young girl, the narrowness of the vagina may offer some difficulty in the extraction. In a case of this kind, M. Flaubert was obliged to break the foreign body and remove it piecemeal. However, as the canal which we have to traverse is easily dilatable, it is scarcely possible to suppose that it can be an insurmountable obstacle to the termination of the operation of cystotomy.

Having removed the stone the woman is replaced in bed, and subjected to the care necessary in the usual sequeli of operations for calculus. The consequences in the vesico-vaginal method are usually very simple. Hitherto no case is related in which they have produced death. Generally not even fever attends them. No large artery can be opened. The peritoneum is too high up to run any risk, and the cellular tissue in the septum too dense to admit of urinal infiltration. The wound, however, does not always heal in a way to please either the surgeon or his patient. Its location alone might have induced the supposition that it would turn frequently to fistula, and experience unhappily confirms the conjecture. Without including in the account any of the patients first operated on, who continued to be afflicted with it, though it is not mentioned in the reports of their cases, it is certain that in three cases M. Clemot saw it once; that three patients treated by M. Flaubert are affected with it; and that the one whose case M. Rigal, jr. related, was not more fortunate; whence it follows that this occurrence takes place once in four cases. M. Coste thinks that it might be avoided by approximating the edges of the wound by suture immediately after the removal of the stone; but then vaginal cystotomy would be rendered an extremely long operation; and we may even entertain some doubts from our experience of such attempts for the cure of vesico-vaginal fistula of the common kind, whether we should derive from it the success upon which this surgeon seems to calculate.

§ 2. *Urethral Methods for Extracting Stones.*

For many years past, perineal lithotomy in the female has been done almost entirely by cutting into the urethra. This canal is so very distensible, that for a long while it was thought practicable to remove stones from it without any sort of incision. Bartholin speaks of a patient who expelled a calculus of the diameter of more than two inches; Borelli of another which was as large as the thumb. Middleton relates that in a fit of coughing a woman passed one which was four ounces in weight. Heister has collected some examples of the same kind, in which it will be seen that a stone as big as a nut or even as a hen's egg, passed through the urethra by natural

efforts alone. Francis Collot mentions one of the size of a goose egg, which occasioned ischuria of eight days' continuance. Molineux states that he has seen one which weighed two ounces and a half; and that of which Yeloli speaks, weighed upwards of three. In conclusion, some even still larger are recorded in the bibliotheque of Planque. Kerkringius, Morand, Grunewald, and the scientific compilations both ancient and modern contain many more not less extraordinary. Although many of these stones may have come from the uterus and vagina, and not have formed in the bladder, it is incontestable nevertheless that many among them were really expelled per urethram, and that in certain cases this extreme dilation has not been followed by incontinence of urine.

a. *The Method by Dilation* which arose upon these observations, is done in two principal ways; in one we proceed rapidly by means of metallic instruments; in the other, on the contrary, it is done with extreme slowness, and by the aid of pervious bodies for the time left to remain in the canal. The author of the first of these plans is Tolet, and Douglas that of the second.

Sudden Dilation.—The procedure of Tolet consists in introducing the dilating instruments of the greater apparatus into the bladder, and gently separating the branches until it is possible to pass in both fingers and forceps between them and thus extract the stone. The old dilators have since been superseded by the following procedure. A grooved sound acts as a director to a gorget whose anterior portion is narrow which rapidly grows thicker towards its handle. By its assistance, the fore or little finger of one hand then enlarges the urethra from before backwards, to create a passage for the forceps; in what way soever this operation be attempted, it is so extraordinarily painful that many women cannot endure it, and it is, moreover, often followed by incontinence of urine, laceration of the urethra, &c.

Slow Dilation.—Douglas thought that he could do away the inconveniences in Tolet's method of rough and sudden dilation by effecting it with a sponge tent or a dried root of gentian. To this day this plan is pursued by those who think it possible to dispense with incising the urethra. The cylinder made of the cœcal appendix, introduced collapsed into the bladder filled with water and then drawn forwards from behind as Bromfield advises; and the same kind of dilator contrived by M. Arnolt are not more advantageous; and a sponge even has this advantage, that it allows of our placing in its middle a catheter which will give exit to the urine in cases in which it is necessary to retain it long in the part.

It would be wrong to suppose after all that this species of dilatation was much less painful than the other, or that it protects the patient against incontinence and the many other accidents which the former is accused of causing It is very certain that pure and simple incision, as it is now performed, brings with it no more danger, causes less pain, and allows of a more speedy relief to the patient; so that dilation, whether slow or sudden, is suitable only to such stones as do not exceed five or six lines in their smallest diameter.

b. *Urethrotomy.*—Incision of the urethra may in fact be performed at any part of the two upper thirds of the circumference of this canal.

Fleurant has proposed to divide it on both sides at once with a double lithotome introduced closed, and withdrawn open; beginning the incision at the neck of the bladder and terminating it at the meatus urinarious. Lewis,

who adopted the same method, preferred cutting from before backwards. For this purpose he had invented a flattened sheath open on the sides, into which passed a double edge-cutting instrument from without inwards. Le Blanc, to whom he communicated his project, suggested to him that an instrument which cut, or a sheath which was open only on one side, would do equally well. But all the procedures done with the like instruments are now fallen wholly into disuse, and all that is necessary for performing cutting of the urethra is a straight bistoury, a grooved staff, or a brother Come's lithotome; unless indeed we renew Fleurant's proposal, when Dupuytren's double lithotome may find a new application. The oldest method, and that which has been longest pursued, is that which consists in passing a grooved staff into the bladder to act as director to a long straight bistoury with which the whole extent of urethra is obliquely divided from top to bottom, and from right to left. But this procedure, which has been simplified by F. Come and M. Dupuytren by the use of a sheathed lithotome instead of the bistoury and staff, was often followed by wounds of the vagina, and also admitted of a division of the superficial vessels of the perineum, a swell as of the pudic artery itself if the incision were extended a little too far, and it has owing to these circumstances been generally abandoned since the adoption of the plan of cutting the urethra directly from above downwards. The date of the origin of the last method goes back at least to the sixteenth century, though attributed to M. Dubois. Pare gives the credit of it to Collot; after having given a plate of the grooved staff, he says: "Other practitioners operate in another way, as I have seen master Laurent Collot do often; which is not by putting the fingers into the breech, nor into the neck of the womb, but by simply placing directors in the urethra; then after, they make a small incision, quite above and in a straight line from the orifice of the neck of the bladder, and not on one side as is done in men." As revived by M. Dubois it is now executed in like manner as the former, with a bistoury and staff, or with a sheathed lithotome. In the first case we introduce a stout staff, the groove turned uppermost, and ending in a cul-de-sac. The surgeon holds it by the handle in his left hand, and with it presses down the forepart of the vagina forcibly. With the right hand he passes in a straight and sharp bistoury upon it, with which he incises the upper wall of the urethra in all its length, and the surrounding tissues as far as the sub-pubic ligament. Thus we obtain an opening of six or eight lines, which is sometimes increased to eight or ten, whilst tractive efforts are being made upon the stone. It would not be safe however to attempt the removal through it of a stone of more than twelve or fifteen lines in size. I have seen one of these dimensions extracted by M. Bougon from a young woman who perfectly recovered; and M. Thomas of Tours was not less fortunate in a similar case. It is of consequence when we withdraw the forceps to press strongly against the inferior plane of the canal, and to raise the handles sufficiently to make them act in the axis of the lower strait. Otherwise the stone and the blades of the forceps also will be stopped behind the symphysis, and the surgeon will create an insurmountable difficulty, while he at the same time exposes the woman to dangerous contusions. A good operator was for a long time delayed by this obstacle in 1824 in one of the hospitals of Paris, and after all the stone, which was easily extracted when the direction of the forceps was changed, was no bigger than a partridge egg!

Art. 3.—Recapitulation.

From this detail it appears that no species of perineal cutting on the female allows of our extracting large stones. The lateral incision, or the lateralized itself, could not in this respect be of much service. The upper incision, being situated in the pubic arch at the top, necessarily gives a very small opening. A bilateral incision without any doubt would offer greater advantages; but as yet experience has not proved that it could be practised with any chance of success; and reasoning strongly leads to the fear, that to separate thus the urethra into two parts would cause fearful urinous infiltrations, or produce an incurable incontinence. Still I think with Dupuytren, that it would be well to take this question into consideration and decide it by the authority of facts. When we consider that in the female sex lithotomy is most often called for by large stones, we must choose between hypogastric cutting and that per vaginam. Fistulæ, which too frequently follow the first method, are so disgusting an infirmity, and so generally incurable, that we shall seldom decide on adopting it until quite sure that we can succeed by no other. Now, *cæteris paribus*, the other being the easier because of the lesser height of the pubis, and the greater rise of bladder above the strait of the pelvis, and having always seemed less dangerous than in man, it should, I think, be preferred in every case in which the bladder retains its dilatability; inasmuch as that those calculii which we cannot extract by incision of the urethra will require a too large opening in the vesico-vaginal septum for us not to fear the production of a fistula. To sum all up, it appears to me that dilation will do for small stones—the upper incision for those which are not larger than a small egg—that the oblique incision should be attempted if the stone is only a little bigger, or if the vagina is not dilated by it to a degree which makes its lesion almost inevitable, whilst vaginal cutting is proper only for stones as large as a hen's egg, or at most a turkey's; supposing that we are on no account willing to go above the pubis, which operation is however the only one after all which is suited to stones of a still larger size.

It is useless to add that the position of the patient, assistant, and operator—the apparatus—the precautions necessary in extracting the foreign body, and the consequences of the operation, are similar, or nearly, to those which have been under the same circumstances in the male.

Relative Value of the Different Modes of Cutting for Stone in the Male.

One question yet remains to be answered; it is to know which of the methods deserve to be adopted as a general one in preference to the others. To solve the problem we must first consider to what circumstances the fatality of the operation for stone is owing in patients who fall victims to it. Many perish from hemorrhage. Others die from inflammation, abscess, sphacelus of the pelvic cellular tissue, and of peritonitis. Some seem to be hurried into the grave by organic affections, more or less distant from it; such as diseases of the brain and viscera, ataxic and adynamic symptoms; serous or purulent effusions in the pleura, and especially numerous abscesses of the parenchymatous organs. Besides these lesions there are others which are

infirmities merely; such are incontinence of urine, division of the rectum, and urinary fistulæ of every kind.

Recto-vesical cutting is, it is true, less liable than any other to pelvic suppuration, and to metastatic abscesses. But it is more often followed by phlegmasia of the bladder and intestines. It undoubtedly most often gives rise to urinary fistulæ, and does not allow, as is generally supposed, of safer extraction of large stones than any other method.

Hypogastric cutting can be attended with hemorrhage very rarely—it is safe from fistulæ—almost always from inflammation of the bladder, from incontinence of urine, intestinal phlogosis, and the multiplied foci of suppuration in distant parts. It allows of the extraction of very large stones, and is not difficult to perform; but the wounding of the peritoneum is of itself alone a very alarming accident, for if an inflammation of this organ ensues death almost always follows. It must, besides, be added, that no where are abscess, gangrene in the cellular tissue of the pelvis, and infiltrations more to be dreaded; and that no where have we less means of avoiding them.

Perineal Cutting, which exceeds the limits of the prostate, exposes the patient, though in a less degree to similar infiltrations, to wounds of the rectum in some cases; to recto-vesical, recto-urethral, or simply urethral fistulæ; to incontinence of urine; and also to metastatic suppuration in a greater degree than the two preceding ones; which is, I think, in part owing to its dividing large veins which inflame and also to small abscesses forming about the wound, the pus from which in some way or other enters the general circulation. As it is confined within the circle of the gland, it allows readily of our avoiding both arteries and intestine; can be but seldom followed by idiopathic or symptomatic abscess, and really has no other objection than that of not allowing a large enough passage for very large stones. In that case the bilateral operation or the multiplied openings of the method of M. Vidal will furnish us with a sufficient resource; and incontinence of urine or the fistulæ urinariæ, which in this case might be dreaded, are neither frequent enough nor so difficult of cure as that we need be much afraid of them: so that perineal cystotomy is after all that which possesses the greatest advantages, and which is entitled to conclude our analysis to the preference as a method of general adoption.

Recto-vesical cutting will be adopted only, as I think, as an occasional exceptional method; in cases, for example, wherein tumors, ulcerations, and alterations of greater or less depths in the perineum do not allow of our going through this region; or else, when the stone is found fastened to one end in the prostate; in diseases of this gland, as ulceration, or when it is the seat of an excavation which would make it dangerous or difficult to attempt an incision upon its sides; or when the stone seems to have thinned or ulcerated the recto-vesical wall itself. The high apparatus should be reserved for performance on very large calculi occurring in children and in women, when the bladder can be easily distended or the operation is not rendered difficult by the *embonpoint* of the patient. However, it is worthy of remark, that if obesity be an obstacle to hypogastric cutting, it has on the other hand the advantage of removing the peritoneum from before the knife, by means of the quantity of fat which usually accumulates between it and the parietes of the abdomen. In case of meeting with horny hardness or thickening of

the walls of the bladder, we must consider them as belonging to the list which justifies recto-vesical lithotomy, unless perineal cutting can be applied to them.

D. *Nephrotomy.*

Our science is possessed of numerous cases of stones retained in the kidneys themselves; and there acquiring considerable development, so as to cause the death of the patients. Hence the idea of nephrotomy has originated, which may be defined the incision of the organ through the healthy tissues, and that of an abscess upon the stone which may be felt through the lumbar region: or else, the mere enlargement of urinal fistula, with a view to favor the exit or extraction of the foreign body. One cannot deny that it may be possible to come upon the urinary gland by its posterior surface, by dividing the soft parts of the side between the last rib and crest of the ileum on the one hand, the sacro-lumbar mass, and posterior edge of the oblique muscles on the other. I have often succeeded in pursuing this plan, and my opinion with regard to it is perfectly in accordance with that of M. Gerdy.

But when it is remembered that it is scarcely possible to be satisfied that stone exists in the kidney by any physical means, and that all its rational signs are more or less deceptive; when we reflect again, that though its presence even be admitted, it is yet to be ascertained whether it occupies the entrance of the ureter or the pelvis of the kidney, instead of the thickness of one wall of the organ. Whether it is or is not accompanied by ulceration, by purulent secretion, in short, by any disorganization whatever, we must renounce nephrotomy so often as no external appearance shall indicate the point upon which our search should be begun.

There is, moreover, no proof of its ever having been attempted. The passage cited from Hippocrates I do not think refers to it. The much boasted operation on the bowman can have no weight in such a matter; for it is a circumstance which may well be a sheer fabrication. Who can place any confidence in it, when it is seen that Mezerai makes this criminal come from Bagnolet, while Monstrelet places him at Meudon; that some authors rank it under the reign of Charles VII; others under that of Louis XI; that Collot and the author of the History of France are of opinion that it was to nephrotomy that he was subjected; Rousset and Sprengel that he was operated on by the high apparatus; Mery that he was cured by perineal cutting, while Tollet asserts that it was gastrotomy to remove a volvulus?

The case of Hobson, the consul, is not more conclusive, upon whom it is said to have been performed by Marchettis. Bernard, who relates it, had no other authority for the fact than the statement of the patient and of his wife, and yet Marchettis says not a word about it in his "*D'Observations Rares.*" It is to be hoped, that the discussions originated in the schools of surgery, in 1784, by Masquelier and Bordeu, and Coussinot a century before, to settle whether nephrotomy was applicable or not, will never again be revived. It can be proposed with propriety only in the very few cases in which the side, presenting evident fluctuation after numerous symptoms had existed of calculous affection in the kidney, will allow of our reaching with facility and certainty the focus of disease; again, in such as are attended with a fistulous

ulcer, which allows of the stone being touched with a sound; and lastly, in which the calculus itself projects outwardly, and may be detected through the integuments.

The operation then becomes so simple, so trifling, and must be varied to suit so many circumstances, that it would be useless to describe it in detail. All that can be said about it is, that having made our opening large enough, or having sufficiently increased that which previously existed with a bistoury alone, or directing it upon a grooved conductor, we must seek with caution for the stone, and extract it either with common forceps, polypi forceps, dressing forceps, hooks or scoops; or sometimes the fingers alone will suffice.

Calculi impacted out of the Bladder.

1st. *In the Ureter.*—What I have just said of calculi fastened in the kidneys, applies with greater force to those which are impacted in the ureters. Although they may be retained at any part of this duct in its whole length, it is especially in its upper third, and towards their vesical extremity, that they are met with most frequently. They may under the first of these circumstances ulcerate and pass in part into the cellular tissue of the side and so create an abscess, which may be opened above the crest of the ileum, or make its own way through this region. A patient, who died quite suddenly in my department at La Pitie last year, offered a remarkable peculiarity, which the reader perhaps will not be sorry to see inserted in this place.

The kidneys were in a perfectly healthy state, as were also the left ureter and the bladder which contained no stone; but the right ureter, largely dilated for about three inches below its origin, was perforated behind by a stone as large as a nut, which projected into the cavity, and extended outwardly at the bottom of an abscess beneath the ascending colon. In the centre of this calculus was a pin. The stone appeared to have caused all the great thickening, induration, engorgement, and suppuration even of the cellular tissue and muscles, which extended from the kidney to the bottom of the pelvic cavity, so as almost to close up entirely the lower strait of the pelvis.

This stone, as I satisfied myself on the dead body, might easily have been extracted through the flank of the same side. But who could have assured us of its existence during the life of the patient, and who, without such certainty and on mere suspicion, would have ventured to perform such an operation?

2d. *In the thickness of the Vaginal Septum.*—If a calculus concretion forms between the urethra and vagina, of which M. Macario relates a case, and its presence can in any way be determined, its extraction should be effected by incising through the vulvo-uterine passage, and to a suitable extent the thickness of cyst separating it from the urethra.

3d. *In the Prostate Gland.*—The gland which surrounds the commencement of the urethra suppurates and ulcerates very frequently. Urine, by being effused in the small hollows which are thus formed, may deposite gravelly particles susceptible of acquiring more or less considerable dimensions. At other times calculi stop, and are fastened simply in the width of the canal which it encloses. These may either be pushed back into the bladder or seized with a forceps fitted with a sheath (*pince a gaine*) and drawn out; or

they may be broken into pieces *in situ.* On the contrary, the others can be seized through the urethra but with very great difficulty. We are obliged to seek for them through the perineum. The same is to be said of those which are formed sometimes in the substance of this region; either after the operation for stone when some fragments of gravel have been caught in the wound, or when a small calculous concretion has escaped into the adjoining tissues, owing to some laceration or to an ulceration of the urethra. The position of the patient is the same in perineal cystotomy. After the introduction of the catheter, where no impediment exists we are to seek anew to determine precisely by the finger the position of the stone. The operator then cuts upon it and lays it bare. If he does not think the first incision large enough, he enlarges it by commencing at its angles, protecting his instrument upon a director. The extracting agents then are the forceps, the scoop, or the fingers. On this subject Louis's memoir, inserted among those of the academy, may be advantageously consulted.

4th. *In the Urethra.*—Stones are met with in every part of the excretory duct of the urine, in which, when of any size, they speedily give rise to very serious difficulties. When stopped behind the meatus urinarius, or in the fossa navicularis, it is seldom that the gush of urine and the efforts of the bladder are insufficient to expel them. If it be otherwise, however, we are to seek for them with a pair of dressing forceps, having a beak somewhat flattened and concave; or, as Sabatier advises, by slipping beneath them a loop of some metallic wire, brass for example; and else by the aid of a small scoop, of a hook shape, as was done by M. Civiale in the case of M. Boissean in September 1828; and lastly, if all these means are attended with too much difficulty, by incising the lower wall of the urethra in front of the stone, by carrying a narrow bistoury into the canal, and bringing it back from behind forwards; unless we prefer to make use of a sort of sheathed bistoury, such as is used by M. Civiale under the name of *uretrotome.* One indispensable precaution, whatever be the mode we adopt, consists in fixing the penis firmly with the thumb and forefinger behind the calculus so as to favor its expulsion, or at least to prevent it from being pushed backwards by the instrument. When the stone is locked in the beginning of the spongy portion which, from the gradual construction which the canal experiences hereabouts, is often seen, the surgeon in like manner fixes the hinder portion of it with one hand, and with the other endeavors to withdraw it with the metallic loop of Sabatier or of Marini, such as M. E. Rousseau has recently employed with success. This not sufficing, we resort to the *pince a gaine,* having denticulated grasps made thin, firm, and concave, and only separating when they arrive at the anterior surface of the stone to dilate the urethra as it were, so that the foreign body when pressed by the finger may come easily between them. To be sure that we have it, and that we may not uselessly close the forceps, M. Civiale advises that they should be traversed by a stylet, the head of which opens the forceps when withdrawn towards the sheath. The operator feels with this stylet where the stone is, displaces it when it is unfavorably grasped, and runs no risk whatever of injuring the patient. When it is once firmly seized it is drawn out, slowly if rather large, and so as if possible not to produce the least tearing. If the size of the calculus renders it difficult of extraction, which it seldom does as it can hardly have been long enough in the urethra to

have increased much in size, its fracture, if fragile, must be effected, or else it must be drilled with a perforator for this purpose carried in instead of the stylet, so that it may afterwards be more easily crushed.

Calculi, which are arrested in the bulbous portion, are to be treated upon similar principles. In the membranous portion, where nevertheless they are found most frequently impacted, more difficulty will evidently be experienced. If the preceding attempts which may be modified by a change of instruments, by using for instance a forceps more or less curved, all fail, and the affection is urgent, incision into the urethra becomes our sole resort. It is the same also in the other cases we have pointed out, in which drilling and extraction are only measures to be first tried.

Incision having become decidedly necessary, it is thus performed: When stone occupies the second portion of the urethra, an assistant is to keep it fixed there by the introduction of two fingers into the anus. The surgeon with a straight bistoury, divides the integuments previously well stretched, then the cellular tissue, then all the parts contained in the base of the recto-urethral triangle, and comes down upon the foreign body. Having sufficiently enlarged the incision, he extracts the calculus with the assistance of suitable instruments, and for fear there should be others in the bladder, prostate, or in the remainder of the urethra, he examines all these parts with a grooved staff, a female staff, or any species of catheter. Behind the scrotum the spongy portion of the urethra has such movable coverings that they are in general easily enough divided. For this reason it is proper to carry a grooved and very strong staff through the natural passage to the stone; to raise the scrotum as much as possible; sedulously to stretch the integuments; to have the stone supported behind by the fingers of an assistant, and make the incision into the integuments longer than that into the urethra itself. The object of this, is firstly to come more surely on the foreign body; secondly, to prevent infiltrations. The same course is to be pursued for stones which lie in front of the scrotum, save that the scrotum has then to be crowded down towards the anus. It is important in these cases not to open the urethra at first at more than one point over the stone, and then to enlarge the incision on a director backwards or forwards. By an opposite procedure we should produce a jagged wound, with edges more or less fringed, far from favorable to cicatrization, whilst the latter mode produces one which is very even, and the fittest possible for instant adhesion, or at least for a very speedy one.

As to Philagrius's advice, who recommends in order to avoid fistula that we should open into the urethra through the dorsum-penis, it would be found applicable only for very small stones stopped in front of the scrotum, and I do not think that even at any rate it will be revived. Besides is it quite certain that Philagrius meant to speak of opening of the urethra rather than calculi and opening of the bladder? Moreover, fistulæ after incision into the urethra such as I have often described, are much less frequent than one might have supposed. M. Civiale relates the case of a patient operated on at La Pitie, by a pupil at that hospital, who had three bulky stones in the bulbous, membranous, and prostatic portions of the urethra. The operation was long, laborious, created a very uneven wound, yet was not followed by a fistula. The division heals of itself, and only requires as perfect coaptation as possible to be maintained between the different layers

through which it goes, and to be covered with lint spread with cerate. It is of no benefit to leave catheters in the bladder, which indeed interfere with the recuperative efforts of the organization.

5th. *Between the Gland and Prepuce.*—Children are, as we have said, very subject to contraction or stricture of the preputial opening, and the covering of the glans penis in them is naturally very long. From this it results that the urine spreads into it as into a sac before it escapes outwardly on leaving the urethra, and that it there forms frequently stony concretions, which are also, though much more seldom, seen among adults. They may acquire a a size which is truly astonishing. Morand preserved one which was as large nearly as an egg, and which had a furrow on its upper surface for the passage of urine. Sabatier was the owner of another which was larger still. The extremity of the penis on these persons is swelled, heavy, and dependent like the clapper of a bell. Their removal is extremely easy. All that is required is to introduce a director between the foreign body and the prepuce, on which a bistoury is passed down, which cuts and divides the tissues from within outwards. This might as well be done from without inwards by acting perpendicularly on the calculus. An operation of this kind made a great noise in Switzerland at the beginning of the last century, and was said by some persons to be a case of super-pubic lithotomy.

§ 2. *Lithotrity.*

Cutting for stone is still so dangerous, notwithstanding the many improvements it has undergone, that efforts are constantly being made, to render it unnecessary, and to substitute for it some operation of a less cruel nature. There are many who think that this desirable end has at length been attained by modern surgery; and that by means of lithotrity we may for the future, in a very great majority of cases at least, dispense with performing lithotomy. We shall see as we proceed how far such hopes may perhaps be entertained.

Lithotrity, or the breaking of a stone by grinding and bruising it, consists in the comminution of a stone into fragments, and their extraction *per vias naturales*, by means of particular instruments for that purpose. In its widest signification it comprises pure and simple extraction, crushing, pulverization, breaking by bruising, perforation and trituration of stones, even within the interior of the bladder or urethra. The names of "lithoprinia, lythodyalisie, lithotripsy, lithocenosis," which it has been wished to substitute for lithotrity, being no less liable to objections do not deserve the preference which has been claimed for them by their inventors.

Art. 1.—*Historical Account.*

The idea of extracting calculi, either entire or after having been broken, without an incision of the parts is not by any means a new one. For those at least which were arrested in the urethra it has in every age been suggested. Albucasis mentioned an instrument which enabled him to seize them at the bottom of this canal. The sheathed forceps with three or four branches, described and delineated in the Bibliotheque of Manget under the name of Asta, appeared to Fabricius Hildanus, suited to the same end. A

tube with three elastic branches, was in the same way made use of by Sanctorius. Franco with this view had contrived a "quadruple vesical," and Pare a sort of trepan or elevator, "bis-fond," which he passed down to the stone through a canula. Fabricius Hildanus employed a forceps with three branches, which after it had grasped the stone was capable of breaking it. Still, though it has appeared easy to all authors almost to seize small calculi to pierce and break them in the urethra, it is not quite so clear that they ever carried their instruments further on to fulfill the same intent. However, an Arabian author, who is evidently no other than Albucasis, in a work in which the names of Alsaharavius or Acaravius, are given him, says that we must introduce softly a subtile instrument called "maschabarebilia" into the bladder, to seize the calculus, crush it if soft enough, and extract it. Alexander Benedictus also says that a stone may be crushed with metallic instruments without any wounding of parts. Lastly it appears that Sanctorius, Franco, and Fabricius Hildanus, also were accustomed to search for small stones even into the bladder; but the very imperfect details which they have left of their proceedings, are too vague to be of much weight upon the subject.

During the last century, Hoin of Dijon related the account of a monk at Citeaux, who by means of a flexible tube, and a stem of iron sloped at its extremity, succeeded in breaking a stone under which he labored, by striking on it by quick and small strokes with a mallet, as on the chisel of a sculptor. The journals of Calcutta, and subsequently M. Marcet, have made known a fact even more conclusive; that of Colonel Martin who died in 1800, who succeeded in his own case in reducing a calculus to powder by means of a metallic stem which ended in a file, and was introduced into the bladder through a curved catheter. I have been unable, as was M. Civiale, to meet with the work of Dr. Marco, published at Venice in 1799, and entitled "a New Method of dividing a Stone in the Bladder." The forceps invented by Hales, and called Hunter's, enabled Desault to take out three vesical calculi of very small size, and Sir A. Cooper, who modified it, removed with it in this way about eighty from the bladder of a chimney sweeper. None of these however constituted regular methods; and in spite of the much more systematic labors of M. Gruthuisen, Mr. Eldgerton, who also endeavored to break the calculus within the bladder, still employed a curved catheter into which he introduced a rasp, which by a motion backwards and forwards, should wear away the stone. The plan of Gruthuisen, though unapplied and perhaps inapplicable, at least went further than any other. This gentleman delineated numerous instruments, made multiplied experiments, and clearly demonstrated that straight canulæ, 4, 5, and 6 lines in diameter could be passed through the urethra. Although its chief object was to decompose them by galvanic action, he notwithstanding invented an instrument to break them; the apparatus consists of a large straight canula of a loop of brass wire, which enlarges at the vesical end of the tube, and of a perforator which may be pushed out and withdrawn at pleasure. The surgeon seizes the stone in the loop of wire, draws the wire towards him so as to bring the calculus against the beak of the canula, then taps and perforates it with the drill, which is turned by a bow.

The attempts made by Gruthuisen had, like those which preceded them,

nevertheless sunk into oblivion, when several of our fellow-countrymen, impelled by the same necessity, engaged in an attempt to establish lithotrity. Here a difficulty presents itself for solution; to whom belongs the credit of being the original founder of lithotrity as it is now performed?

M. Civiale, who since 1818 had been engaged in searching for a method of dissolving stones in the bladder, and had conceived an idea of some instruments for seizing and breaking them, asserts that he invented those which he now employs. M. Leroy d'Etioles, on the contrary, declares that then M. Civiale had only invented some instruments which were inapplicable to the end; and that he was entirely ignorant of the ("pince") forceps with three elastic branches, which is merely a modification of that of Sanctorius, or the ball extractor of Alphonso Feri. I indeed remember that M. Leroy showed me the forceps which is now in daily use before he laid it before the academy, in April 1823; and that which is to be found in M. Civiale's first book, published in the course of the same year, differs exceedingly from it, and much more resembles the quadruple vesical of Franco. Still it is very difficult to take any side in this affair, particularly as Percy, in his report to the academy of sciences, in 1824, decided wholly in favor of M. Civiale; whilst in the years 1825, 1828, 1831, the same learned body awarded to M. Leroy the prize for inventing the principal instruments, among others the three branch forceps now used by almost every lithotritist. The detail of the various procedures actually adopted, and of the different instruments which have hitherto been used, will oblige us to return to the question, and enable us also to decide more equitably upon it.

Art. 2.—Examination of Methods.

Lithotrity comprises two methods distinct from each other, as to the apparatus which either requires: the one necessitating the use of straight, the other that of curved instruments.

§ 1. *The Rectilinear Method.*

One of the difficulties which longest opposed itself to the practitioner was to penetrate to the bladder with straight stems; so that lithotrity has in reality been created from the period when the possibility of rectilinear catheterism was recognized. The straight catheter then having become a capital instrument, we have no cause for astonishment at the importance which is attached by some persons to its invention. On this point, as in almost every other of the great operations in surgery, we have arrived at the realization of the fact only by degrees, and the real discovery will be found separated from the period of its declaration by a very considerable lapse of time. It may not be entirely proved that Albucasis, Sanctorius, or any other old author had any idea of a straight instrument for entering the bladder; and we may doubt perhaps whether the straight stems found by E. Clark in the ruins of Herculaneum, or if those in the office of a surgeon at Portici, ever were instruments of catheterism. It may be incorrect to say that Rameau proposed catheters perfectly straight, but it is at least undoubted that Lieutaud did formerly promulgate the thought, and that the proposition has been

far from forgotten. It is in fact reproduced in the Elements of Surgery, published in 1768, by M. Portal; and afterwards in the Dictionary of Surgery, edited by Louis. In 1795, Santarelli, a surgeon of Rome, returning to its consideration, attempted to prove that the urethra has no curve in its prostatic portion, and that it is easy to do away that which occurs beneath the symphysis, by depressing the penis. Lassus made similar statements in his lectures at the school of medicine, and M. Montagut confidently asserted in 1810 that rectilinear catheterism is as easy as it is useful in a majority of cases. Another French physician, M. Fournier of Lempdes, who paid much attention to lithontriptic means in the year 1812, employed a straight instrument. The well authenticated certificates collected in the book which he has just published, leave no doubt upon the subject. The work of M. Gruthuisen, published in 1813, at length revealed all its advantages; so that, even excluding the assertions of several army surgeons, MM. Larrey and Ribes among others, who state that they have often used straight catheters on service, it would be quite impossible to claim for our own time entirely the invention of catheterism with straight instruments, which was contended for by M. Moulin, in his turn, as late as 1829.

In fact, custom and prejudice had opposed it; particularly in so much that as a means of entering the bladder and giving exit to urine, a straight catheter is incontestibly much less convenient than a curved one. It was necessary, in order to allow this species of catheterism to take rank in practice, that it should be presented under some other point of view. Between the years 1815 and 1823, the want of some means of destroying calculi without resorting to a sanguinary operation was felt more powerfully than ever, and several surgeons engaged about the same time, in researches on this subject, in similar ways or by different modes. Upon these experiments the possibility of passing the urethra with catheters, &c. not curved was anew proclaimed. M. Amussat, though in order to induce conviction he laid a great stress upon an anatomical error, succeeded at length in awakening the attention of surgeons to the subject. Whilst he was laboring vainly to demonstrate how exceedingly mankind had been deceived as to the real course of the urethra, MM. Leroy d'Etioles, and Civiale seized upon the practical inference, and left M. Amussat to wrangle out the discussion in which he had engaged. It does not appear, indeed, that until then they had thought of a straight sound for fracturing the stone; and the instruments of M. Leroy were still straight at that time. The statements of Lieutaud, Sautarelli, Montagut, and the labors of Gruthuisen, which would have been of such great service to them, had evidently escaped their observation. We may then say with every confidence that from this period only does lithotrity date.

Breaking up a stone is now practised in divers ways, so different that each requires a succinct analysis. In one, that which was first practised on the living subject, we are content to perforate the stone in several directions; then to break it into fragments, and to perforate or break each of these one after the other, and extract them piecemeal, unless the bladder should itself expel them along with the urine. In the other, simple perforation alone is not considered sufficient. The surgeon endeavors, by means of special lithotritic instruments, to excavate the stone from centre to circumference, to reduce it to a shell which is then reduced to fragments, and divided as above. In a

third method the instruments act from the circumference to the centre only, and serve to pulverize by true concentric friction. A fourth way of acting is that which aims at grinding or crushing the stone without previous perforation either from the centre to the circumference or from before backwards.

a. *Perforation*, pure and simple, which was by M. Civiale adopted from the beginning, is the method which he still prefers. The instruments required for it are, 1st, a large canula from two to four lines in diameter, from nine to twelve inches, which serves in a measure as "chemise" or covering to the other instruments; 2d, of a forceps called *litholabe*, intended to seize and hold the stone; 3d, of a drill, either cylindrical, three or four pointed, or else having a head, and of a trephine shape; 4th, of accessory articles, such as a crank or winch, rings, *chevalets*, mandrel lathe or *tour en l'air*, vices, &c.; all of which serve to support the principal pieces from without, and make them act inside of the bladder.

1st. *The Chemise or outer canula* is a part of every apparatus, and is found in every procedure. When it has been introduced into the urethra it remains in it, and serves to protect it. As it should be moulded upon this canal there must be some of different sizes, of greater or less dimension, according to the age and peculiar structure of the patient. It is requisite that with as thin walls as possible it should combine great powers of resistance; at the vesical end at least. Its outer extremity is usually fitted with a leather or cork box, and cut quadrangularly for an inch or two so as to be seized by the vice or lathe.

2d. The *Litholabe* is the part which has been most frequently varied, and which also constitutes a portion in every procedure. Under this head it is needless to speak of the first instrument by M. Civiale, which was analagous to the quadruple vesical of Franco, nor of that which M. Leroy described in 1822, and which was composed of four watch springs which were capable of forming when extended or relaxed a double loop crossed in the bladder, or having joined to them as auxiliary a net so as to transform this cage into a true sac; or else in the place of springs, branches jointed in the middle to approach or diverge when their external portion is pushed or pulled upon; again, these branches may be of chain work, and by the aid of canulæ may be made to form a cage of three or four branches around the stone by turning one upon the other, particularly as these instruments have never been by any one adopted, not even by the inventors themselves, whilst that of Mr. Lukens, a mechanic in Philadelphia, is no better. M. Colombe has proposed one composed of two concentric canals, each ending in two elastic branches, united at their extremities, and which can be made to cross each other at a right angle round the stone when seized. This instrument is evidently constructed on a similar plan to that of the litholabe of Leroy or of Lukens, and will in all probability suffer a like fate.

Thus far surgeons have generally resorted to the forceps properly so called. This—which is a mere modification of the triple canula of Sanctorius or Hildanus, of the ball extractor of A. Ferri, or Andrew de la Croix—has also been that for whose invention most persons have advanced claims. M. Leroy first made it known in April 1823; but it is asserted by M. Civiale, who has given us a delineation of another in his work printed in June 1823,

that ever since the year 1820 he had been engaged in experiments with an instrument constructed upon the principle of the Ferrian ball extractor. Three elastic branches, which are curved crotchetwise and lap over so that they may be closed and reduced to the dimensions of the principal stem when withdrawn into their sheath, compose its vesical end. The other has a leather box, but no vice such as the first canula has. The litholabe, such as I have now described it, has not suited the wants of all lithotritists. Several have endeavored especially to increase the number of branches. Some have given it four. M. Amussat has proposed five. Meirieu divided them into twelve. M. Tanchou prefers ten. That which M. Recamier has proposed is composed of two canulæ, which have each of them five, and which by turning on one another soon form a forceps of five or of ten branches. These different alterations have all been made with the view of holding the stone, when once laid hold of, with greater firmness and security, and not to let fall the principal fragments. The litholabe of Meirieu, successively perfected by MM. Recamier and Tanchou, is distinguishable from every other in having a hole in the free end of every branch to allow passage to a silk string of great strength, which is intended to close them as does a purse string; and which passes through a particular groove in the canula to get outwards. That of M. Recamier can moreover, by the rotation of its two canulæ, present a large opening on one of its sides to the calculus, and close afterwards around the foreign body. In the apparatus of Meirieu and Tanchou we meet with the same contrivance, but under another form; that is to say, one branch of the forceps remaining in the canula leaves a lateral aperture to receive the stone, and then by pulling on the silken string may be thrust out level with the others. Recently Dr. Ashmead, of the United States, has presented one to this academy which has four divisions; three of which are pretty near each other, and the fourth sensibly divergent. In this way the forceps leaves on one side all necessary space for receiving large stones, and represents in the other direction a firm grating which is to be turned downwards during the grinding that no fragments of any size may escape. It would, no doubt, be better if we could keep hold of a calculus until its entire destruction was effected; but all the instruments proposed effect this advantage at the sacrifice of a great many others. By multiplying branches you necessarily weaken it much. As calculi are very far from having regular shapes, or from being seized by their centres opposed to the centre of the forceps, it would be very much to be apprehended that one of these many stems might have to bear alone the whole effort, and consequently bend and break. This accident would be rendered much less alarming by uniting the ends of the branches by silk strings as in Meirieu's plan; and the little cage offers a good deal of regularity; but may the string of silk not break? may it not become entangled in the stems of the instrument? and are we always certain to be able to make it play freely? Besides having once closed the litholabe, how are we to disengage the stone from it if the bladder chance to empty itself and contract violently? If the forceps of three branches will not answer, that of Dr. Ashmead, which, while it preserves more strength, allows of our obtaining a tighter grating than a common forceps, can alone be substituted for it I think, at least, in the procedure by simple perforation.

Lithotritors.—This is a stem or rod of steel, the vesical end of which is to

act upon the stone, and which end alone can be susceptible of any material modification. In M. Leroy's first apparatus this rod was cylindrical, and terminated by points. In the instruments of M. Gruthuisen there is one to be found whose extremity has a head shaped like the crown of a trephine. This latter form is preferred by M. Civiale. It follows therefore that his lithotritor has to be introduced at the inner extremity of the forceps, and can only be withdrawn along with the whole instrument; while the cylindrical drill enters and is taken out at the outer end, on the other hand these drills with heads make a much larger perforation evidently than the others; and M. Civiale, to obtain a yet larger opening, has had some made which were excentric, that is to say, whose axis was outside that of the rod. With such an instrument a stone may be perforated through and through; but prudence generally requires us not to go on quite to its farthest extremity, or at least not to the level of the hooks of the forceps, for fear of wounding the bladder. The advantages which it has are its great solidity, its acting powerfully and surely, and that it endangers the occurrence of no serious accident. The real objection which is made to it is that it can only make an opening of three or four lines; that it requires the position of the stone to be changed frequently, and increases the number of sittings necessary if the stone be a large one.

Development Drills.—Struck with the imperfection just mentioned, several surgeons have attempted to remedy it. M. Leroy, one of the first, constructed some drills, the "*fraises*" of which were more complicated, and with opening or developing points (*lances*). Likewise a drill split at the end, by which he could first pierce the hole, and then enlarge it, because when the *fraise* was pushed out of the canula its two branches separated forcibly owing to their natural elasticity. Another instrument of the same kind appeared to him to be capable of answering the end still better. The two branches diverged by the retraction of the head of the drill between them. At length M. Leroy, still following up the same idea, employed successfully a cylindrical rod enclosing a double blade *fraise*, which when pressed upon issues through two apertures placed near the extremity of the drill. He has besides invented a simple bent file very much like that of M. Eldgerton; also a double one with two elastic branches, but none of these are worthy of being retained in practice except his drill with two apertures enclosing the double *fraise*, which has two branches equally elastic.

The double *fraises* of M. Civiale, which are separated by a transverse bar or a simple head being drawn back through them by the power of a return screw acting on the central stem, do not seem to me to deserve to be retained either. It would appear that M. Heurteloup had been attentive to the improvement of which we are now speaking. In order to obtain an excavation of eight or twelve lines in diameter, he employs a drill with a cylindrical head and an aperture on one side, and which serves at first for piercing the stone. When afterwards he wishes to begin to hollow out and excavate the stone so as to reduce it to a mere shell, he pushes out the base of a denticulated shoulder *virgule* which is contained in the crown of his drill, and which escaping directly through the lateral aperture exceeds its circumference by one, two, or three lines. This shoulder, though jointed, possesses great solidity, and its inventor has frequently employed it in practice with the completest success.

b. *Excavation.*—For calculi of a still larger size M. Heurteloup uses what he calls his "forceps excavator" (*evideur a forceps*); that is to say, a cylindrical drill with a jointed *fraise* capable of lateral divergence so as to give rise to an excavation of more than an inch in diameter; the first glance of this instrument however forbids us to attach much confidence to it, and shows that it can possess but little strength. M. Amussat has also attended to excavation. His drill, which is constructed on the principle of one by M. Leroy, is composed of a central crown and two lateral points. When the stone has been pierced into with the closed instrument, the stem is drawn back by a screw between the two *fraises,* which it separates in such a way as to allow of a very considerable increase of the excavation. This instrument has been successively modified by two distinguished cutlers, MM. Greling and Charriere; the one giving a firmer support to the two lateral wings; the other a more rapid divergence, and supplying them with a solid stay fixed to the surfaces of the crown of the drill by two little perpendicular supports. It is quite certain that, as constructed by M. Charriere, this drill seems capable of creating an excavation of from six to eight lines quite as easily as the common *fraise* of M. Civiale will produce one of three or four.

The cylindrical drills with a *virgule* or shoulder which diverges three or four lines from the axis of the principal rod, such as have been advocated by MM. Tanchou and Pecchioli, seem to me to be much less convenient. I must say the same of the triangular pointed, wind-mill armed counter sinks invented by M. Pravaz; and of that which has been just recommended by M. Rigal de Gaillac, with its sheathed drill. This surgeon, besides, has proposed to himself a plan other than that of any his predecessors. When the perforation is effected, a return screw draws back the *fraise* between the two blades which makes the *chemise* or sheath, separates them, and fastens them solidly against the centre of the stone, which is as it were set into a handle made by the drill, in such a way that it may be bruised against the inner surface of the litholabe. M. Rigal also thinks that by opening the forceps of his instrument the stone may be shivered by excentric efforts. Herein he has followed in the steps of M. Civiale, who proposes a similar measure after lithotomy, where a stone is too large to be removed without danger; of M. Leroy, who says the same respecting calculi in the urethra, as had previously been suggested by Fischer and some other authors in the last century but one. By way of recapitulation, we may observe that it is doubtful whether lithotrity by excentric rupture will ever become a method of general adoption, whether it be effected by sheathed drills, by divergent blades, or by percussion on the free end of the lithotritic instrument. As to excavation, the instrument which will do it most safely and solidly, is the elastic double branch fraise of M. Leroy, as perfected by M. Amussat; although the mandrel (*a virgule*) by M. Heurteloup, and the development forceps by M. Pecchioli, are calculated in many cases advantageously to supersede it.

c. *Concentric Friction.*—Instead of opening the stone through its centre, and excavating it from its interior outwardly, Meirieu has conceived the idea of grinding it to powder by acting upon its surface and towards its central portion with a cylindrical drill supplied with two shoulders, which develop laterally, capable of being voluntarily widened, and of making a sort of clover leaf with the stem. MM. Recamier and Tonchou have followed the

same plan, and their efforts have had no other aim than to render its application more easy by improvements either in the litholabe or the lithotritor. It is not possible to deny the greater rapidity of this sort of trituration; that by means of it we may in fact pulverise a large stone at a single sitting; that it guards against all risk of parcelling the stone into fragments, or that it allows us to keep it fast until all is finished without letting it go. But the drills and fraises which it is necessary to use are unavoidably weak and may bend and break. The separation from each other of the *virgules*, leads to the apprehension of their becoming entangled with the branches of the forceps if it is necessary to bring them too near the sheath. We have besides all those inconveniences of which I spoke when on the subject of the litholabe with many branches connected by silken strings. The essays of Meirieu, and those of M. Recamier have been performed only on the dead body. M. Tonchou on the contrary has gone farther than this. He has just announced to the institute that he had been enabled by means of his instrument to grind to powder at one sitting a stone of some size, in a patient who is now perfectly cured of the calculous affection. He also last year performed in my presence several attempts upon an adult man whom I sent to him for the purpose. The stone could not be seized, however, and I thought it proper to cut him for it. We then ascertained that the foreign body was of entirely too large a size for lithotrity by any method to have succeeded. It would be unjust therefore to refuse to M. Tanchou's apparatus the possibility of being applied with advantage. There is something at first sight very ingenious, nay, very plausible in M. Rigal's plan of concentric friction by means of the inner surface of the litholabe, against which the stone socketed by the sheathed drill is made to turn; but the slightest reflection will serve to show that is an idea which must remain unapplied.

d. *Crushing the Stone* is one of the methods to which the ancients paid particular attention. Accordingly it is crushing and not friction which we find mentioned by Acaravius, and which F. Hildanus and others performed. M. Amussat likewise operated by crushing in 1822. This method of treating calculi, for a while forgotten seems now likely to dispute the palm with lithotrity properly so called. Some among those who propose it, adopt it only as an accessory method, and for small stones, or the fragments which follow perforation or excavation; others again, seek to extend its fame as a generally applicable method. In the first case it has usually been combined with the other methods. M. Civiale, when he finds that the stone he has seized is only three or four lines in size, for instance, immediately compresses it with great force between the branches of his litholabe, and crushes it at once by pushing the head of the lithotritor with the palm of the right hand. He does the same with all fragments of any size, or too considerable to be drawn on trial through the urethra. M. Civiale had also contrived a forceps with two grasps, capable of sliding over each other and crushing small stones by a backward and forward motion, very like that of M. Amussat. This instrument has been modified by M. Rigal, who made it act through the medium of a return screw, dispensing with the motion backward and forwards. M. Columbat thought it might more easily be managed, by adding to it flyers to make it move, and by fastening a small chain to the end of each grasp, to draw it out without danger if it should chance to give way and break. The forceps constructed with this view, which has attracted most notice, is

that of M. Heurteloup, delineated in his book under the name of "brise-coque" (shell-breaker). The two grasps rub on each other, and are enabled to re-enter the external canula by means of spring-work, which they do with such power as to shiver into splinters the hardest stones, and those which offer the greatest resistance. I have seen this surgeon use it at the school of *Perfectionnement* and cure two patients, each at a single sitting. It is an instrument whose compressing force is perfectly incalculable. It is much to be regretted that it is able only to undergo very trifling divergence, and can therefore include small stones merely. A forceps was constructed by M. Rigaud, in 1829, while yet engaged in the study of medicine, upon nearly the same principles, but instead of two grasps having three. It is a sort of grinder which can lay hold of stones of an inch in diameter, or more even, just in the way that the common litholabe does. Spring-work machinery of a very complicated kind in the handle, enables the three branches to move and to exercise friction on three parts of the stone at once, which reduces it to a fine powder, and allows of its entire destruction before it is let go. It is a stone, or shell-breaker, which is not so powerful as that of M. Heurteloup, but which has the superior advantage of destroying the stone by friction, instead of shivering it into fragments. Still more recently, a clever cutler, Mr. Sirhenry, has constructed another forceps equally capable of crushing the stone. It is of three branches, which have no hooks, and have a denticulated crista on their inner surface, which is applied on the foreign body. It is introduced into the bladder like the common litholabe. When the stone is fairly laid hold of, the branches are drawn back into the sheath by a return screw, which acts with such prodigious power that silicious stones and pebbles cannot resist it. In an attempt which was made with it some time since at the Hotel Dieu, one of its branches broke; and this is indeed the fear which a view of it at first inspires; but to this Mr. Sirhenry replies, that the instrument used was an extremely weak one, never intended for such large stones, and that he had warned them of the possibility of the accident. Certainly, that one which he showed me, and before which the hardest calculi gave way, was possessed of such strength that it appeared really impossible to break it.

Some persons have urged as an objection to it, that the bladder is liable to be injured by the fragments of stone which are scattered by the instrument. This danger is clearly chimerical. No pain resulted when a stone was thus shivered between my hands, and as we act in the bladder filled with liquid there is nothing to be feared in this quarter. Surely the brise coque of M. Heurteloup, and some other instruments of which we have yet to speak, should possess similar inconveniences which nevertheless have not interfered with their application on the living man.

e. *Of the Four Ways of Breaking Stones.*—No particular one deserves adoption to the exclusion of the others, nor does any deserve absolute proscription. Perforation of a stone of five or six lines is very advantageously combined with crushing; for after the fraise has made an opening, say for example of four lines, we may, after having drawn it near the sheath, pull the litholabe forcibly backwards, and afterwards use it as a "*brise coque.*" Instead of this procedure we may, if the exploratory means used have demonstrated almost certainly that the stone is a small one, employ the grinder of M. Heurteloup,

or some one either of the spring-work flyer, "*volant*," or rectum-screw forceps previously described. When the stone exceeds ten lines or one inch, perforation, excavation, and then crushing are successively proper. To conclude, to me it appears incontestible, that with Rigaud's forceps we should succeed without much difficulty in breaking calculi of from eight to twelve lines in diameter; and the same I think might be done more easily still by that of Mr. Sirhenry.

One remark which must not be allowed to escape observation is, that with crushing forceps the operation is made wonderfully more simple, as drills, strawberry-shaped files (*fraises*), supports, &c. become all useless. So that if their employment ever becomes general, it will be a very certain means of making lithotrity popular,

§ 2. *Curvilinear Method.*

It is a singular thing that bruising of calculi could never be effected until the possibility of passing straight instruments into the bladder was demonstrated. To render the proofs of this possibility incontestible, serious anatomical errors have been maintained; and now when no one entertains a doubt on either of these subjects, every one perceives that curved instruments are perfectly able to fulfill the end which had been aimed at for so long a time.

The file-mandrel or stylet (*mandrin a lime*), used by colonel Martin, was carried through a curved sound. M. Eldgerton's instrument had the natural curvature of all catheters, and so had the first lithoprionic instrument invented by M. Leroy. The most difficult point in this system was to turn the lithotritic instrument on its own axis. However, M. Pravaz triumphed over this obstacle, and in 1828 succeeded in rendering the motions of a drill, strawberry-shaped file (*fraise*) quite as easy in a curved as in a straight canula. To accomplish this he transformed the lower fourth of his perforator into an articulated stem, into a small chain not less solid however than cylindrical rods made of a single piece. Still his instrument which had an arch of a long circle, did not possess all the advantages which it was intended to have: and the inventor finished by giving it a curve like that of ordinary catheters; that is including in it only the vesical fourth. M. Pravaz failed with this instrument in an application of it at one of the hospitals in Paris, on the living subject. This want of success might be owing however to a want of practice, to the indocility of the patient who was but a child, and particularly to the peculiar situation of the stone. It would be difficult to assert that his apparatus, which in no way but in the direction of its principal pieces differs from any other, should not be capable of producing similar effects. I should even say that it must certainly be much more easy of introduction, and much less fatiguing to the urethra. M. Leroy showed one quite similar as to the disposition of the chain and drill which was curved like a common sound; and which he had yet further to modify in order to adapt it for application to a patient whom it was impossible to sound with straight instruments. It had this peculiarity, the third branch of the litholabe was fixed, and a component part of the conducting canula. The instrument of M. Pravaz, and that of M. Leroy, admit of perforation, excavation, and friction, like straight instruments; but their shape is

still better adapted to crushing. Mr. Welsh of London, and M. Rigal, have given a slight curve to their friction or spring-work forceps, and M. Jacobson constructed a species of nipper which is equally curved. This latter instrument is composed of an outer sheath or canula like all the rest—then of a cylindrical steel stem which completely fills it, and extends it for three inches towards the bladder—this stem is in two halves, jointed at top, placed the one above, the other beneath, in such a way as that the lower one being pushed forward separates from the upper which is fixed and forms, by means of two or three hinge-like divisions, a loop capable of embracing a stone of twelve, fifteen, or eighteen lines. A return screw at its free extremity allows it to be restored to its primitive position. As it was proposed by the Danish surgeon, it had but two divisions, "*brisures*," in its inferior branch. M. Dupuytren thought that it would be better to give it three, to make the loop rounder and more regular. It is introduced closed into the bladder. Then by pushing upon its outer extremity the inferior half separates a little. This makes a space between it and the other half, which space may be enlarged *ad libitum*, and the extent of which is pointed out by figures on the outside of the nut or box. In this void or loop the stone is engaged. When accurately seized, we act on the return screw, as if to isolate and close the instrument by the approximation of its two branches. Nothing can be more simple than such mechanism; nor need any thing be easier than the operation itself. Here we have not even to fear fracturing the instrument, for its articulations will always allow us to withdraw the fragments without danger. All that can be said against it is that having only two branches it cannot so easily as the others lay hold of the stone, and that if we confine ourselves to crushing it we are obliged to reseize every separate piece. I must add to this, that the detritus of stone which sometimes remain sticking to the inner surface of each grasp are calculated to render their approximation very difficult. M. Dupuytren who used it on a patient was much pleased with it, and four or five sittings were sufficient to enable him completely to destroy a voluminous stone; so that, either as it now is, or after it shall have received such modifications as I conceive it to be susceptible of, this instrument may yet make eccentric friction, either by perforation or excavation much less rare, and in a great many cases do away with the necessity of straight instruments. Adopting the curved lithotritor, M. Segalas also thought fit to modify it in the case of a patient who could not bear the introduction of straight instruments. The improvements by this surgeon chiefly relate to the rod of the perforator, which after his plan, instead of being made with a jointed chain, is made of metallic wires collected into a fasciculus or bundle; and also the means of pulling out the fragments of the litholabe if it happens to break in the bladder, without danger; in all which I see but changes of trifling importance and useless complexity.

M. Heurteloup, returning to the idea of the monk of Citeaux, has proposed a curved instrument which opens after the manner of a shoemaker's foot-rule or measure; and which after having securely grasped or fastened the stone between its blades, allows it to be broken and reduced to fragments by means of blows inflicted with a hammer on the end of its upper or movable branch.

This system, which the author calls *lithotrity by percussion*, has already been several times practised by him with entire success in London: and the attempts which he has made on the dead body in Paris prove effectually that stones may be destroyed by it with more force and quickness than by any other method. Yet as it requires instruments of immense calibre and great strength to avoid breaking inside of the bladder, I am doubtful whether this new method will ever obtain the currency which M. Heurteloup seems to anticipate.

§ 3. *Accessory Apparatus.*

Whatever be the lithotritic system we have chosen to adopt, the means by which it is set in operation deserves the attentive consideration of the surgeon. The mechanism of stone-breakers (*brise-pierres*), of shell-breakers (*brise-coques*), of saxifrages and grinders (*grugeoirs*), having throughout been brought forward in the system of return screws, double levers, spring-work (*encliquetage*), or wheel and catch work (*engrenage*), makes a part of the principal instrument, and requires no separate description. Not so however with breaking, properly so called, effected either by perforation, excavation, or concentric pulverization. Two orders of springs then become indispensably necessary; 1st, to keep the litholabe firmly together; 2d, to make the lithotritor act.

Under the first intention, the chevalet (*easel*) a sort of lathe, "*tourenl'air*," proposed first by M. Leroy, after Ducamp, and slightly altered by MM. Civiale, Rigal, &c. has generally been adopted. Some persons however have preferred to substitute an ebony vice with one or two handles; but the chevalet is evidently better. Others have exercised their ingenuity in fixing the instruments as well as the patient. Hence the beds with or without support, contrived by MM. Leroy, Heurteloup, Tanchou, Rigal, &c.; contrivances perfectly useless evidently, and which M. Civiale has always been able to dispense with. The bare idea of metallic supports, to remain immovable upon the foot of the operating table as in that of M. Charriere, or the mechanical bed like that of M. Heurteloup is alarming. Let us fancy to ourselves in fact some sort of forceps and lithotritor working in the bladder of a living man, whilst an inflexible bar of iron planted upon the table fastens them without, and we shall then see whether the least disorderly or unexpected motion of the patient is not of a nature to make us tremble for the consequences. However ingeniously they be contrived, the use of this artificial force must be abandoned, and their place supplied by able assistants or the hand of the surgeon himself. By pressing with his chest against the lithotritor, through the intermedium of a crescent-shape handle, in such a way as to hold the litholabe with his left hand, whilst with the right he turns the drill with a wooden instrument like a wimble. M. Amussat avoids all these dangers; but he acts with less power than by employing a lathe and tires himself much more; so that all things considered the easel or chevalet does best after all.

There are two powers to be directed in the action of a drill; that which presses upon its outer extremity to keep it in contact with the stone, and that which obliges it to turn upon its axis. Those persons who supposed that

they could find the former in the thumb, the forepart of the chest, or the knee, have evidently deceived themselves; unless they could discover a system which is a better combination than that of the wheels, wimbles, and cranks hitherto invented. The spring *en boudin*, enclosed in the movable "*poupee*" (puppet) of the lathe certainly is far from satisfying our wants. Still as long as the drill-bow shall continue to be preferred as the rotary agent, I see nothing by which it can be advantageously replaced. Rings, flyers, handles, which would seem at first sight sufficient for the power of rotation, have not an extended action, and neither sufficiently favor the forces set in play, and their movements are of little service. The catch-wheels placed beneath, as in M. Leroy's contrivance, and as are again proposed by M. Rigal, or on the side as in M. Pravaz's apparatus, whether they act upon a pinion placed parallel to the axis of the litholabe, or whether they catch in an indented pinion, conical and circular, give to the drill as rapid a motion as is required; but the means of compressing its extremity with sufficient force at the same time still remains to be discovered. The mechanism of the drill-bow is the same in lithotrity as in any of the mechanical arts in which it is employed. Until wheels can be substituted for it, prudence requires that its use be continued, and the good end which it has already answered after all allows us to repose more confidence in its use than in that of any other instrument which tends towards the attainment of the same object.

Art. 4.—*Method of Operation.*

Before we proceed to perform lithotrity, there are some special precautions to be observed. Supposing the urethra to have been diseased, its natural dimensions must first be restored as well as its original dilatability. Even though this canal should be wide enough to allow the instruments to pass, it must nevertheless be subjected for some days to the action of bougies or flexible sounds to dull its sensibility, and accustom it to the prescence of foreign bodies. With this view it is often useful for the same reason to inject the bladder several times to diminish its irritability, that it may the more readily allow itself to be distended at the time of the operation. Though not indispensable these are preparatory steps, which except in a very few persons should not be neglected.

a. *Position of the Patient.*—In civil practice it answers very well to let the patient lie on his back on the edge of his bed, his pelvis supported by a rather hard cushion, his feet resting upon two stools, and the head slightly bent upon the chest. In one's own house, or in a public institution, he would be placed on a narrow bed of a convenient height, so that his legs might project beyond the foot of it, and be sustained as in the preceding case. In this position he neither requires to be tied nor bound; the posterior wall of the bladder becoming the lowermost it allows the stone to go further from the urethra; and thus, as it were, to offer itself to the litholabe. It is easy to alter it according to necessity, either by giving the pelvis a loftier elevation, where the stone has a tendency to stay in the bas-fond or by diminishing the thickness of the cushion when the contrary is feared; a resource which we have not to the same degree in lithotritic beds or tables.

b. *Injections.*—A first stage of the operations consists in filling the blad-

der with warm water or some emollient decoction. But for this the lithotritor and litholabe could not play freely; the stone could not always be seized; and the organ would be pinched almost infallibly. It is done with a common catheter and a hydrocele syringe much more surely than by bladders, or india rubber bottles, or by the sheath, or canula of the litholabe. The silver catheter when introduced serves anew for feeling the presence of the stone. An assistant takes hold of it for the surgeon to adapt the pipe of the syringe, and send on the liquid. When eight or twelve ounces are thrown in, or better still when the patient expresses a strong wish to urinate, we withdraw the catheter and instantly substitute the lithotritic apparatus before there has been time for the injection to be returned.

c. *Introduction of the Forceps.*—The drill, slipped into the canula of the forceps, and fitted with its box to receive the bow; the litholabe in turn introduced into the common sheath and furnished with a box at its outer extremity, so that its branches closing exactly upon the grooves in the head of the lithotritor, which represent an olive made smooth with some tallow, are then passed, united into one instrument, like a catheter into the urethra. To do this, the operator standing on the right side of the patient lays hold of the penis with his left hand, as in performing the common introduction of a catheter; raises it a little; presents perpendicularly to it with the right hand the instrument well oiled or greased; enters the meatus urinarius slowly, by gentle rotatary movements; speedily arrives at the bulb; stops for a second; powerfully, yet gently depresses his hand to get underneath the symphysis, through the membranous and prostatic portions of the urethra; and so clears the neck of the bladder.

d. *Finding the Stone.*—Before the litholabe is opened, he is to find the stone, by feeling about backwards and forwards with the olive-shaped extremity of the still closed metallic instrument; 1st, from before backwards, upon the median part of the bas-fond and posterior wall of the organ; 2d, from behind forwards, as if to complete the circle, returning by the right or by the left side; 3d, a second time from before backwards, returning by the side opposite to that last passed over, coming back to the centre into which the stone may have fallen, and then transversely, so as Dr. Ashmead says to leave no portion of the floor of the bladder untouched. If we can find nothing after this minute search, it is better to postpone the operation than obstinately persist in continuing it. Still it should not be abandoned until after the position of the patient had been varied in every way, and we are perfectly sure that no natural excavation or depression has been overlooked.

e. *Opening the Forceps.*—When he has discovered and approached the situation of the stone, the operator takes and holds firmly the end of the litholabe in his right hand, and uses his left hand to draw towards him the outer canula, as if he was going to take it out of the urethra, and thus allows the forceps to open by removing the restraints upon the natural elasticity of the branches. The bladder runs much less risk in this way than if he slipped the litholabe forward without disarranging its sheath, with a view to save the urethra, the entrance to which moreover is perfectly filled up by the neck of the triploid as it opens in the urinary sac.

f. *To find the Stone again and grasp it* is often much more difficult than

is supposed; especially, as Dr. Ashmead says, because feeling it is not always sufficient to point out its exact situation. This search for it, now requires the utmost care. The difficulty is to say whether we are touching it; 1st, with the convexity of one or both the lower crotchets; 2d, by the middle, inner, or outer part of one of the branches, and if so, whether the right branch or the left; 3d, by the inferior surface of these same branches near the prostate. The following rules on this subject should not be neglected.

If, in balancing the instrument it is perceived to fall upon the foreign body with the sensation of a double clash, the stone is situated beneath the two branches and behind the prostate.

If one branch descends lower than the other when turned upon its axis, and but one collision occurs, it will be found on the highest side.

If it lies forwards, and the two hooks alternately and not simultaneously pushed on equally detect it, it may be said to correspond to the space between them.

If one only strikes upon it, it must be upon one side. To detect whether it be the right or the left, we are to keep one crotchet motionless, whilst the other is gently made to advance. Let us, instead of this, suppose it to be outside of the left branch; then taking the other for the fulcrum, it is to be raised and lowered by rotatory movements which describe the arc of a circle, and will then not fail soon to detect it, whilst the same motions performed on the opposite side will cause nothing to be perceived.

A transverse limited movement, first to the right and then to the left, will in like manner inform us if the stone is within the litholabe, nearer to one branch than the other, or in the centre. These different manipulations, done with a little address, will not leave us long in doubt as to its real situation if the surgeon has taken the precaution to place inferiorly two branches on the same level.

Such being the state of things, it cannot be very difficult to include the stone in the area of the instrument, nor consequently to grasp it. Not to derange the relative situation of the different objects, the surgeon takes the free end of the forceps and raises it a little with the right hand, so that its branches may be kept in contact with the floor of the bladder; after which, taking hold of its leather box with the left hand, the canula or chemise is pushed down upon it. It is also advantageous, previously, to draw the drill backwards and forwards in the tube, and between the divisions of the litholabe, until the fraise has absolutely touched the stone. By an effort in a contrary direction, on the sheath and on the stone, the concretion is finally fastened, and then nothing remains but to attack it with the lithotritor.

g. *Applying the Lathe and the Drill-bow.*—This is now the time for applying the supports and agents of motion. A pressure screw first prevents the two closed instruments from reopening. A mortice which there is on the top of the lathe then embraces, seizing it underneath the quadrilateral extremity of the sheath in front of the box, which extremity is furnished with lateral edges, and a pressure screw fastens them at once in this position. The little cup of the spiral spring, supported by the puppet of the lathe is then applied to the tail of the drill. The puppet is pushed forward with a violence proportioned to that action which we intend to exercise upon the

drill and on the stone. It is stopped by a turn of the screw. If the pressure of the spring appears too great, a fourth screw enables us to suspend or continue it at pleasure. The apparatus is then ready. An assistant turned towards the pelvis, and standing on the right side or between the legs of the patient, takes charge of it, and seizes it by the handle in the right hand, and near the curved portion with his left. The operator takes the loosened cord of the drill-bow, passes it around the box which has been previously placed upon the drill, and brings back the buckle to be attached to the end of the elastic arch, from which it had been for a moment separated; always recollecting that the string though it should be delicate should also possess great strength, and work with as little friction as possible.

h. *Friction.*—This being done, the surgeon still standing on the right side, holds the instrument firmly with his left hand between the penis and the head of the chevalet or easel; whilst with his right he makes the drill-bow act, carefully inclining the effort forward, and combining pressure against the stone with rotation unless the spring seems to be sufficient. The drill box has moreover been arranged in such a way as to strike against the drawing box of the litholabe, before the head of the drill can reach the vesical extremity, and go beyond the circle of the forceps.

Having finished this preliminary perforation, we are to draw back the puppet of the lathe so as to bring back the drill towards ourselves. If the stone is friable and small, we try to break it before letting it go, by acting powerfully on the two cork boxes in an opposite direction. If not, we open the forceps moderately, and then by striking gentle blows on the free end we try to move the stone and to change its position; which change we may effect by the assistance of the drill directed by the right hand. If nothing will succeed in effecting it, we must wholly abandon the stone, and seize it again precisely as if it had escaped by accident from the operator. For fear it may not present by exactly the same diameters, which is extremely rare, we push the drill hard against it, so as to move it again if it falls into the same hole; and not set it again in motion with the bow, except so long as it meets with a solid portion of substance to destroy.

The use of development drills, of strawberry-shaped files with shoulders (*fraises a virgule*), and files with single or double wings, is subjected to similar rules, whether originally made use of, or only after the first perforation. In the first case, we must so separate them as that they will turn freely behind the stone, without touching the inner surface of the branches of the litholabe, and so that the central may serve as the axis to the lateral wings, whilst they are acting on the stone. In the second case we open them only by degrees, and even within the first perforation. The name of "*echoppeur*," graver or excavator, then really becomes applicable to them, since they serve to reduce the same to a shell, and to hollow it out into a conoidal cavity whose summit removes backwards. Spherical stones of rather large size, taken centre for centre, are best adapted to it; those which are elongate, which are grasped laterally or by some projecting part, and which leave a void on one side between the branches of the forceps, render their action difficult and sometimes dangerous, owing to the unequal resistance which they meet with in turning. M. Tanchou's apparatus, though more ingenious, is not wholly

free from this inconvenience, and I think it in such cases most prudent to confine oneself to simple friction and crushing combined. When the stone is entirely powdered, or the patient is too much fatigued, say in five, eight, ten, and at the utmost twelve minutes, the sitting should be completed. We take off the bow; loosen all the screws to take off the chevalet or easel, and withdraw the drill as we keep closing the forceps. When a fragment adheres to their branches, it is, if not too large, drawn out with the remainder of the instrument; but if there be any cause for fearing its action on the urethra, it is better to let it go, and allow it to fall into the bladder again, by pushing it back with the lithotritor. The remains of the injection and the urine, which the patient is usually very anxious to void directly afterwards, almost always bring with them pieces of calculi, and a greater or less quantity of powder, resulting from the grinding, which are the best proof, so far as the patient is concerned, of the success of this operation. We advise a bath on the same evening or immediately. In general, all the treatment which the case requires is that which is called for by states of convalescence of any kind, or by invalids usually. At the end of two, three, four, or five days, according to the agitation of system produced by the first attempt, we begin again, and again observe the same precautions; and so on until no further vestige of stone exists in the urinary bladder. One or two examinations with the common sound, at intervals of some days, are necessary to produce certain conviction on this point, and ought upon no pretence whatever to be omitted.

Art 5.—Remarks on certain Points in the Method of Operation, and on the Accidents which occur in Lithotrity.

In spite of the leather boxes, and the accuracy with which the three principal pieces of the apparatus fit into one another, it sometimes happens that the injection escapes between them, or else between the outer canula and the walls of the urethra. A "*tubulure*," or neck, placed upon the back of the chemise or sheath, and made to communicate with the bladder by a groove hollowed out upon the external face of the litholabe, is now added to almost every new instrument with a view to remedy this inconvenience. The pipe of a syringe may in fact be added to it, so as to make a catheter of it, and renew the injection; but the irritability of the organ soon brings matters to the same point, though happily it is not often entirely emptied.

Lithotrity before puberty is not so easy as it is in the adult. 1st. Because of the imperfect development of the genital organs, the narrowness of the urethra, the unmanageableness of the patients, and the exquisite sensibility of the parts. The instruments should not be more than two lines or two and a half in diameter, which sensibly lessens their power, whilst at a later period of life this may be extended to four lines, although those of three lines or three lines and a half are generally sufficient.

They are still less adapted to early infancy for the same reasons, and moreover because the bladder, rising too high in the pelvis, augments in proportion the curve of the hinder third of the urethra, and thirdly, because cutting at this period of life offers a great chance of success.

The prostate gland in some persons makes its application difficult, owing to

the crowding back of the urethra behind the symphysis. In such cases, curved instruments are in a measure necessary. M. Leroy struck with this want, and desirous of doing away with its importance, and having often times experienced the danger and impossibility of straight instruments, has proposed a measure, in appearance a very simple one, which he calls *redresseur*, straightener of the urethra; composed of a gumelastic catheter introduced crooked, and when in made straight again by a straight mandrin which is pushed slowly into it from before backwards by a screw. This instrument resembling that which M. Rigal has contrived in the same view, and which might well be superseded, as M. Pravaz remarks, by the cylinder of the lithotritor, carried with the hand, by spiral movements through a large flexible sound, open at both ends, endangers the occurrence of serious accidents, such as contusing the verumontanum, and tearing the urethra by means of the screw or the nut of which we cannot calculate the power; and also because the head of the *mandrin* or stylet makes its way by striking against every point of the inferior wall of the canal. That of M. Tanchou, would be decidedly preferable, if straightening the urethra were a precaution really necessary to be taken in such cases, as it is formed on its vesical third of a series of small jointed pieces, which allow of its being introduced curved, and straightened when in, without the slightest friction. But if rectilinear catheterism is not practicable, it is according to my view of the case much better to resort to curved instruments, or even to lithotomy, than to rely on such means.

Extreme development of the prostate brings with it another inconvenience; it changes the bas-fond or trigone of the bladder sometimes into a deep excavation, in which the stone is not always easily seized. The fingers of the surgeon himself or his assistant introduced into the rectum, would I think be preferable for raising and offering it to the claws of the litholabe to the little bag invented by M. Tanchou or any species of tampon whatever, which could be slipped up above the anus.

Lithotrity *upon females* is infinitely easier than in man, and almost without danger. In them the canal being wide, distensible, short, and not curved, free from prostate gland or seminal orifices, adapts itself admirably to the passing in of the instruments necessary, neither does it require as entire a pulverization of the calculus. The only thing is that they have somewhat more difficulty in retaining the injections, less indispensable however in a naturally large bladder, supple, and so to speak, beneath the eye; so much so, that in a very few sittings a little girl of three years old was relieved of a large calculus, notwithstanding that no liquid could be retained in the urinary reservoir.

Curved instruments, either those of Pravaz, Pamard, or Leroy, being intended all of them for the same species of friction as that apparatus whose application I have described, demand no particular detail of their method of operation. The principal advantage they possess is that of fatiguing the urethra less, causing less pain consequently, and of penetrating into the bladder more freely. As on the other hand they are less convenient than the others for sounding the organ, finding and seizing the stone, it is useless to attempt their use in females. It may indeed be laid down as a principle, that, *cæteris paribus*, straight instruments are best suited for performing lithotrity by perforation, excavation, or concentric friction; whilst curved instruments answer better for crushing the stone.

If the "grinder" (*grugeoir*) of M. Rigaud were curved, and if it were possible to lessen its size a little without decreasing its strength, it would deserve frequently to be employed, and would be equal to the task of crushing any stone not bigger than a nut. It is introduced in the same way that all other instruments are. To open it, it is held towards the urethra by the left hand, whilst the right acts on its handle by an effort which displaces the screw and nuts. When it is ascertained that the stone is between the claws, it is closed by an opposite effort, after which a see-saw motion and circumduction of the wrist suffice to set in action the friction of the grasps upon the foreign body. The shell breaker of M. Heurteloup, whose motions are very much the same, requires pretty nearly the same management, except that the spring-work in it compels it to re-enter its sheath at the same time with some violence; thus crushing the stone rather than grinding it. Its action indeed is more rapid, but is attended with the creation of splinters and fragments which have afterwards to be seized; whilst that of M. Rigaud cannot let go its hold until the last fragment of stone it contains is reduced to a fine powder.

Mr. Jacobson's instrument being one of the easiest to manage will probably be oftenest employed. None less exposes the bladder to injury. A mere jointed loop, having neither hooks nor free points, it is almost impossible that it should either pinch or pierce the walls of the organ; so that strictly speaking, it might be used without premising an injection. Its curve renders its introduction as easy as that of a common sound. The way to open it is very easy. The nut being brought back to the end of the screw we apply the palm of the right hand on this end and push. The jointed branch of the forceps opens forthwith in the bladder, as if to form the circle of a rocket or battledore, rather irregular, owing to the dorsal concavity preserved by the other branch. We proceed to search for the stone according to the rules always given. When the calculus is entirely encircled by the metallic loop we pull upon the screw, first with our hand as if we were closing a litholabe, and then with the screw nut, which becomes in this case a return screw, which, causing the two halves of the stone breaker to act like two large files rubbing upon the stone in opposite directions, concentrates its whole action upon the latter, and scarce can fail of crushing it. The numerous fragments which follow it are submitted to a similar treatment and search. The surgeon needs no assistant, and the patient feels but little fatigue, nor does any thing prevent the sittings from recurring at brief intervals. To conclude, the position is the same as for catheterism in general. It is only to be regretted that so many advantages should be counterbalanced by a greater difficulty in finding and seizing stones of small size: of being certain that we hold them in the loop of the forceps, and by the impossibility of extracting with it any of the fragments.

To accomplish the extracting of fragments, M. Heurteloup employs a large sound, either crooked or straight, terminated at its vesical extremity by a sort of thimble, called the magazine, which may be unscrewed at pleasure. Laterally, and at about an inch from the summit, are two large apertures fronting each other. The other end has its cork box, a stop cock for injecting, and rings that it may be held by the fingers. The liquids introduced with its assistance into the bladder, bring with them, as they flow out again through the apertures all such fragments of stone as are capable of entering and

passing through them. Those which are too large for this are stopped at the orifices. The inventor then uses a jointed, flexible stylet, like the lithotritor of M. Pravaz, to break or crush the point which projects inwardly into the magazine, and press it to the bottom, whilst the remaining portion falls back into the bladder. When from more or less frequent repetition of this manœuvre the magazine becomes filled, the instrument is withdrawn for it to be unscrewed and emptied, and is then reintroduced if it is thought advisable to begin over again. M. Leroy conceives that this end may be better accomplished by an instrument of the same kind, but in which the central stem may act equally by pressure as by rotation. Without absolutely rejecting the assistance of similar contrivances, we are nevertheless obliged to confess that the probable advantages to be derived from them, are not evident enough for practitioners hastily to adopt them, or to supersede by them, or add them to other instruments of more acknowledged excellence.

Accidents.—Those which follow lithotrity, though seldom of a fatal nature, are varied and numerous. The pain which naturally attends the operation is sometimes excessively acute. As it depends more particularly upon the traction of straight instruments upon the sub-pubic portion of the urethra, it is to be hoped that the use of curved instruments will diminish its severity. Every sitting is succeeded in a great many patients by a paroxysm of fever, more or less violent, characterized by the same phenomena as an intermittent. This is an occurrence to which even simple catheterism gives rise, and obliges frequently to prolong the interval between the sittings. In many cases we shall notice engorgement of the spermatic cord, epididimus, and even testicle itself; which is explained to be owing to friction and contusion sustained by the verumontanum and ejaculatory canal. Tears or rents of the urethra, urinary infiltrations, abscess of the perineum and scrotum, though less common, have nevertheless occurred. The chief inconvenience of these events is that they oblige us to defer to a later period, the date of the next operation. It is, however, but just to say that one of the persons lithotritized in my presence by M. Civiale, was attacked with slight engorgement of the testis from the first sitting, was not prevented by it from coming every third day to have the stone triturated, and without having reason to repent of so doing. A bath daily; venesection, if in a plethoric subject; demulcent drinks, poultices, leeches, and the concomitant items of an antiphlogistic regimen if the symptoms are threatening, combined with rest and tranquillity, are the means to be adopted for moderating or removing them.

Hæmaturia when slight and unaccompanied by fever demands but little attention; cystitis and peritonitis, which M. Marjolin tells us he has observed, and such nervous phenomena as all writers on lithotrity mention, require under this the same treatment as under any other circumstances, and are owing either to the pain caused by the introduction of the instruments, the friction of forceps, or of the stone, when it has become angular, against the bladder.

The same remark applies to incontinence, partial or entire paralysis of the organ, and to the weight and burning sensation felt about its neck. Fragments of stone may become arrested in the urethra in such a way as to close it quite, and produce retention of urine and frightful agony. The

means of relieving this accident will be found in the previous article—Stones in the Urethra.

Punctures of the Bladder, on which many persons have laid much stress, are doubtless possible, for M. Brischet witnessed the operation, but they must be infrequent in the hands of cautious operators. I need scarcely say that the aid of art would be attended in such a case with little hope of advantage, unless the perforation were without the peritoneum.

One of the accidents about which we are justly most solicitous, is pinching the organ. Happily it is one which we can almost always avoid. To do this it is sufficient to be careful never to shut the forceps hastily, and never to approximate their grasps until we have felt the stone between them, and at the same time drawing them towards the urethra; all which are easily done when the bladder has been previously filled with a certain quantity of liquid, so as to surround the stone. But where the bladder contracts violently and will retain nothing, when the patient is agitated or the instrument is directed by an unskillful hand, it is easily conceivable that the inner walls of the organized sac may become entangled in the hooks or branches of the forceps, and run a great risk of being lacerated. Of this the operator is admonished by the cries and acute suffering of the patient. Flakes of the natural tissues withdrawn along with the instrument often furnish melancholy proof of the fact. Peritonitis or cystitis is the almost necessary consequence of such an injury, and requires the usual remedies.

Finally, it is possible for the instrument to break in the cavity of the urinary pouch. If the fragment remains perfectly at liberty, every attempt to extract it by the natural outlet will be evidently useless, and our surest course is to perform lithotomy without hesitation. The litholabes invented by MM. Meirieu, Tanchou, Recamier, Jacobson, and that of M. Pravaz, modified by M. Segales, being kept together at each division by joints or strings, are generally safe from this accident, as they allow the separated portion to be drawn out with them.

Art. 6.—*A comparative Examination of Lithotrity and Litnotomy.*

Scarcely was the breaking up of the calculi known, than it was upheld by its partisans as a perfectly innocent operation, and one wholly free from danger. Others have gone so far as to suppose that it was calculated some day or other to do away with any surgical operation for the cure of calculus. The public upon both these points have been deceived. Lithotrity as now performed is in substance a longer and a more painful operation than cystotomy, and I have seen persons, among others one who was cut by M. Souberbielle, after some attempts by M. Civiale, declare they had suffered more in one sitting from lithotrity, than from all the manipulations of cutting for the stone. One fourth, if not one third of those who submit to it, suffer some accident, and it is not true that no one ever dies from it. It was clearly proved by M. Heurteloup, that instead of one in forty M. Civiale lost eight patients out of forty-eight. Of those of M. Leroy three died out of twenty-eight; and an analysis of operations performed at the school of Abou Zabel in Bagdad; by Mr. Watteman and others in Germany; in England by Messrs. Liston, Costello, Heurteloup; in France by MM. Amussat, Bancal, Roux,

Dupuytren; in fact by different surgeons in almost every country in the globe, proves that this is about the best result which has as yet been obtained. If we take all the patients with calculus who have presented themselves to lithotritic surgeons, and on whom the operation of cutting might have been performed, the result is even less encouraging. Of the eighty-two spoken of by M .Civiale, thirty-one were dead at the expiration of a year, and nineteen others recovered only after having met with some accident or other. M. Leroy was able only to cure radically twenty-five. Out of ten who offered to him, M. Bancal was enabled to operate only upon two; so that among those who are chosen as its subject, there perished one in ten or twelve at least; and in a given number of patients, some being subjected to lithotrity, some cut, and others left to the resources of the organism, one-sixth or one-eighth at least are lost. Looking at lithotomy under this aspect alone, it is quite alarming enough, and it was unnecessary for the enthusiastic admirers of lithotrity to have darkened the picture of its ill-success to disgust the public and dissuade the greater number of patients from undergoing it. Still, though there be authentic records proving that eight hundred and twelve persons cut for stone in Paris at the Hotel Dieu and La Charite two hundred and fifty-five died between the 31st December, 1719, and the 1st January, 1728; others again demonstrate that Cheselden lost only twenty-four out of two hundred and thirteen. While M. Sanson tells us that he has seen six die out of twenty, M. Dupuytren on the other hand about the same time performed the operation on twenty-six persons before meeting with the loss of a single individual; and Dr. Dudley, of Transylvania University, Ky. met with a like success in seventy-two cases. Though we may not admit the wonderful success which is by some persons attributed to Raw, or believe that it was possible for this surgeon to succeed fifteen hundred times in succession, which simply means, that out of all his cases, he succeeded in curing fifteen hundred, it seems very certain that Mr. Martineau of Norwich has lost but two in eighty-four; M. Pansa of Naples five in sixty; Ponteau two in eighty; Lecat three in sixty-three; M. Pajola of Venice nearly the same proportion; M. Viricel of Lyons three in eighty-three; M. Ouvrard of Dijon three in sixty; Sancerotte one in sixty; and that of Deschamps at one time succeeded nineteen times in succession. These it is true are but partial data. The same operators have not been always as successful; but why should not the same thing happen in lithotrity? Although we admit that in 1826 M. Civiale had lost but one patient out of forty, must it not likewise be confessed that he has not since been as fortunate, and that his practice at the hospital Necker, according to M. Larry's report to the Institute, offers a much more considerable proportion of reverses. Nor is it possible to expect from every one the same ratio of success as from a man so practised as is M. Civiale.

We must not come with prejudices such as these to the consideration of subjects of this importance. Senac was perhaps justified in saying that most of the patients operated on for stone in the Parisian hospitals died; for in the year 1725 there died sixteen out of twenty-nine at La Charite. Another person, with equal propriety, might have maintained however that only one perished out of eight or nine; for twenty-two recovered out of twenty-five in 1727, and twenty-three out of twenty-six in 1720, at the same institution.

All this did not prevent Morand from discovering that in this hospital seventy-one deaths had occurred in two hundred and eight cases in eight years; and at the Hotel-Dieu within the same period eighteen out of five hundred and ninety-four cases. M. Souberbielle lost eighteen out of fifty-two in 1824 and 1825, but his mean proportion is not less than one in six or eight. Notwithstanding M. Richerand's opinion that the successful and fatal cases were about equal in number at the beginning of this century, MM. Roux and Dupuytren have established them in the proportion of five to six. Lastly, if figures must be made to speak, the following are the results of the best kept statistical accounts which have been published in twenty years.

At Norwich in five hundred and six cases, seventy deaths; at Leeds in one hundred and ninety-seven cases, twenty-eight deaths; at Bristol one, in four and a quarter cases; at Luneville one, in fourteen cases.

In the account of M. Dupuytren, which includes Paris and its environs, there have been in ten years sixty-one deaths out of three hundred and fifty-six cases, or one in six. Lithotrity I am well convinced is less fatal than this; but it is necessary to ascertain how much less it is so, and this point experience does not yet enable us to decide. In the settlement of the question it becomes conscientious men to consider that those persons whose cases admit of lithotrity are the very ones in whom lithotrity would best succeed; whilst all those to whom trituration is inapplicable have likewise not much chance of being cured by lithotomy. The problem therefore cannot be solved definitively, until a certain number of hundreds of calculus persons subjects for lithotrity shall be taken, which shall be divided into equal parts, and one half lithotrized, and the other half cut.

Though lithotrity may have fewer dangers, it is not in every case possible to practice it. It is absolutely repelled by calculi, the nucleus of which consists of some solid body, such as a pin, a needle, a ball, a piece of wood, of horn or ivory. The same may be said of all calculi which adhere, are encysted, or in any other way made immovable; of such as are extremely hard which are larger than a hen's egg upon which the bladder is kept habitually applied; if individuals who have deformity of urethra, either congenital, such as hypospadias, epispadias, or the result of disease, to such a degree as to make it difficult to use the necessary instruments. The existence of many stones, considerable enlargement of the prostate, a protracted state of ill health, or horny induration of the bladder, will render it for the most part as dangerous an operation as lithotomy. In every other case its advantages appear to me to be indisputable except in children: more particularly if the patient is endowed with patience and gentleness, and is of a somewhat blunted irritability, so as fearlessly to undergo the various manœuvres requisite; if he dreads cutting instruments so much as willingly to submit to be a longer or shorter time in getting rid of it, and to suffer as often as is necessary for the annihilation of his stone the reintroduction of the lithotritic instruments. Although a return of the disease is much more probable than after lithotomy, owing to the remnants of stone which often evade the most cautious researches, if it appears likely that two, three, four, five, or six sittings will suffice, we can have no hesitation as to performing it. Lithotomy is then incomparably more alarming. The latter it is true allows the more speedy and complete removal of the stone, and the pain is in a measure

instantaneous only; but the patient must be confined to bed or the room for twenty or thirty days, whilst in the intervals of the sittings lithotrity scarce disturbs his usual habits.

SECTION III.

The Urethra.

Art. 1.—*Catheterism*

Catheterism is performed for the purposes of giving exit to urine; for exploring the bladder; the cure of certain diseases; and to aid in the success of certain operations, such as the various operations for stone, lithotrity, &c. The instruments with which it is effected have long been known under the name of *catheters*, which in Germany and England they still very generally retain: but in France are more generally called "*sondes*" or "*algalies*"; the last of which words however only applies to hollow tubes of a metallic nature. Solid stems, cylindrical, conical, probe-pointed, or buttoned at the point, of various substances, may also be employed for this purpose. The term "*catheter*" is now understood to mean only the grooved instrument used in sub-pubic cutting for stone.

The object of the surgeon being to penetrate into the bladder of urine by the natural passage, an acquaintance with the structure of the urethra becomes an indispensable preliminary, without which catheterism will expose the patient to very alarming dangers.

§ 1. *Anatomical Remarks.*

The urethra at the adult age is about nine inches long, sometimes seven or eight only, and at other times ten or even eleven; two lines and a half to four lines in width, but not of equal width in all parts of its extent. Its narrowest part is its meatus; so much so indeed that some surgeons have been obliged to cut it before commencing lithotrity. Directly behind it on a level with the frenum we find the fossa-navicularis, which in spite of what may be said of late years in most subjects forms a species of excavation here. Next comes the portio-spongiosa, which extends as far as the root of the penis, and continues insensibly increasing in diameter as far as the portio-bulbosa, which is wider still. This part which is but a continuation of it soon contracts itself very much to become blended with the membranous portion, and is seen beneath the divergence of the roots of the corpora cavernosa penis in front of the sub-pubic ligament. After the membranous portion comes the prostatic portion, encircled as it were by the horizontal aponeurosis of the perineum, situated directly beneath the symphysis, and where the canal hollows itself out to close again, and finally widens anew like a funnel at the orifice of the urethra. It is to be borne in mind that all these excavations exclusively reside in its inferior wall, whilst the contracted portions are nearly circular and comprise its entire circumference. Each of them being deeper behind than before it causes them to form folds in the former direction, like valves before

the progress of the instrument. This inconvenience is especially felt in the fossa-navicularis, and the excavation of the bulb. The former as well as all the spongy portion, contain besides small veins the lacunæ of Morgagni (as they are called) looking in the same direction, and equally capable of impeding the introduction of instruments. The prostatic excavation is still more important because of the verumontanum, which, of a crest-like shape, divides it into two from the end of the ejaculatory canals seen on the summit and sides of this crest and the numerous ducts from the prostate which terminate in it; so that the beak of the instrument frequently encounters here a double depression, extremely apt to lead it in a false direction. I have in some subjects met a little further on before entering the bladder a semilunar fold whose concavity was forwards seemingly dependent on an extension of the lining of the valve of the bladder, and which would equally prove an obstacle to the passage of the sound. To understand the unequal resistance of the urethra, it is merely necessary to observe its relations and the structure of its different parts. Its dorsal side forming the concave edge of the segment of a circle is on that account shorter than the other and less disposed to form plaits. Destitute of cavity, and strongly adherent to the lower surface of the penis, it presents much regularity, and so great strength in its spongy portion as scarcely to be in any danger from catheterism. The corpora-cavernosa, as they go off opposite the bulb to fasten on the ischio-pubic rami, leave a small portion of it uncovered almost in front of the symphysis, where it may be injured by the beak of the catheter, bruised and even perforated when the instrument is carelessly passed and tilted up more than is necessary, so as to butt against the anterior face of the sub-pubic ligament, or of the horizontal aponeurosis which prolongs or continues it below. Behind the *fascia* the dorsum of the urethra, strengthened by the muscle of Winslow and the upper arc of the prostate and the cellular tissue, has nothing to fear from the action of instruments, because moreover it possesses there considerable mobility, rises easily against the pelvic surface of the pubis, and passes gradually into the anterior wall of the bladder.

The urethra, which in the fossa-navicularis is very thin, being no longer embraced as at the meatus by the cavernous tissue of the glans penis, is in some measure reduced to its inner and outer membranes; and is consequently very weak, easily pierced, torn, and ulcerated. A little further on the spongy layer separates its mucous tunic from its outer covering, and sensibly increases its thickness and its strength. But in the bulb this layer becoming too much attenuated and expanded leaves it again to its original resisting power; an arrangement the more to be regretted, as no part is more excavated, and that there we encounter afresh the horizontal aponeurosis. The inferior wall of the membranous portion, instead of being thinner and weaker, is on the contrary thicker and stronger than any where else exclusive of the prostate or the bulb. Embraced by the perineal fascia as by a ferrule, and supported by the decussation of the fibres of the transverse muscles, it is in itself additionally lined by a layer evidently muscular, and surrounded by a fibro-cellular sheath at times of some thickness. It is therefore more common to observe lacerations and traumatic perforations, at the entrance of the urethra, into and at its departure from the bulb, than at this part itself; whilst by way of

retaliation it is the chosen seat of stricture. Quite behind it the lower wall of the urethra is as it were decomposed by the prostate, which seems to be developed between its two natural layers. It follows that the mucous coat is now its only membrane as an independent wall; that this membrane makes one body with the gland, and can neither plait, contract, or be the seat of spasm or contraction; but that it is easy to perforate, excoriate, and more readily takes on ulceration and profound disorganization, or forms abscesses; in a word, that it makes common cause with the prostate gland as respects diseases and pathological alterations. The fleshy fibres between the prostate and the bulb in the urethra, which anatomy compels us to acknowledge, even though practice had not a thousand times demonstrated their existence, do not allow of our doubting the contractile faculty of this canal, or the possibility of spasmodic stricture, which among others Mr. Charles Bell denies. These spasmodic strictures are of equally indisputuble occurrence in front of the membranous portion, and even to the forepart of the penis. I have seen them in two dogs, and the use of a bougie will often enable us to study them in man. It has now happened to me twenty times at least, to push a conical gumelastic bougie to a depth of five or six inches without the slightest difficulty; then directly afterwards to find it so strictured that it required an exercise of strength to withdraw it; that in its withdrawal it was easy to feel the friction and that the canal parted with it in a measure with regret. In some instances besides these contractions have been evident enough to expel the foreign body, and push it forwards several inches before my eyes, although no effort had been necessary to cause its introduction. The value of such facts can be weakened by no speculative reasoning. However, the presence of fleshy fibres is not indispensable to their explanation. The elastic element of the bronchi, the outer layer of the ureter, the deep envelope of the scrotum, the soft, velvet-like cellular tissue of the perineum, &c. all enjoy, I am satisfied, a species of contractility; and yet we may assert that in these lamellæ there exist no muscular fibres.

The direction of the urethra is another point which must not be forgotten. While the penis is in a relaxed state the canal presents a double curve; the one forward and its concavity downward; the other behind, and its concavity upward, of the shape of the roman S. During erection, or when it is raised towards the abdomen, the urethra loses the former, and assumes the direction of the segment of a circle whose concavity is downward; much more concave behind than before, and very much the shape of a rib in this respect. The other is a fixed curve, which begins in front of the symphysis, ends at the bladder, comprising the bulbous, membranous, and prostatic portions; and depends upon the attachment of the penis to the anterior surface of the pubis by a ligament of slight extensibility, whilst another fibrous riband keeps the prostate behind the symphysis, and also upon the circumstance of the bladder being pushed up towards the abdomen by the rectum and the prostate, whilst the urethra outwardly is obliged at the same time to rise upwards and forwards to gain the lower face of the corpora cavernosa.

From all this it follows that the curvature of this canal is not invariably the same; that in extending towards the ischia, as often happens in man, and almost naturally in children, the symphysis and sub-pubic ligament may very much increase it; and that enlargement of the prostate, fullness of the intestine, and

thickness of the perineum must produce effects of the same kind, less difficult to be overcome.

The urethra, therefore, is neither *straight* nor *almost straight*, and to maintain this would now be absurd. Those who, along with Rameau, Lieuteaud, Santarelli, C. Bell, and others, asserted it, could never have thought so, or else their eyes were blinded by a wish to discover arguments in favor of rectilinear catheterism. If the urethra were straight it would be prolonged in the direction of the bulb, following a line which would fall on the point of the coccyx passing over the anus. Instead of this what does it do in reality? It is seen to separate from its spongy tissue gradually from the bulb entirely, to pass through the aponeurosis under the pubis, enter the pelvis, and end two inches at least from the level of the anus, and consequently above the direction of the line of which I have just spoken. This mathematical remark leaves no room for reply, and would alone suffice to establish the question, should any one be pleased to revive it. Still, when the symphysis is short, the prostate of no great thickness, the urethra crosses it nearer to its lower than its upper surface, and the pelvis is large, tractions upon the penis do in a great measure cause this curvature to disappear, and allow of our passing straight instruments without any great obstacle into the bladder; which in turn more or less forcibly depress the floor of the prostatic portion of the canal and cervix vesicæ.

§ 2. *Examination of Instruments and Methods.*

Catheterism, whether, as it is called by M. Roux, it be *Evacuant*, *Explorative*, *Directing*, or *Derivative*, is performed in general after the same rules in every case.

The copper catheters (*sondes*) which were once used were attended with the inconvenience of becoming oxidized, and covered with verdigris, and are now universally superseded by silver ones. Flexible catheters of horn, leather, and spurious metallic wires, having been used only in default of something better, equally deserve to remain in the neglect into which they have fallen since the invention of elastic catheters, by Theden, Pickel, and Bernard the goldsmith. Silver and indian rubber instruments then are the only ones worth preserving; the first for cases in which their solidity is desirable, and in which the catheter is to remain but a few minutes in the urethra; the second for those in which after the operation it is advisable to leave them for some time in the bladder.

The length of a metallic catheter for an adult man is about twelve inches. If shorter they will not in some old men reach all the way to the reservoir of urine. If longer they will expose the bladder to perforation and the organs to injury. Their diameter should vary from two to three lines. Due proportion being preserved they pass better the greater their volume. For children they are made of a line or a line and a half diameter, and from five to eight inches in length. If their sides are too thin, they become liable to bend, get out of shape, or even break on the slightest effort. A contrary construction makes them more expensive, usurps room in their cavity, and will interfere with the flow of urine, unless the caliber of the instrument is otherwise very large. Their free end is generally expanded, of a funnel-shape, and has a small ring on each side, to which on occasion strings or ribands may be attached. At a distance of a few lines from the other end, which is blunt, are two lateral

elliptical apertures, instead of a mere slit which used to be seen in them. We now scarcely use any longer than those which instead of a beak have a stylet head, which is pushed forward to open them and which closes them when drawn towards ourselves; nor those either which are free and open at the vesical end. The curve which has been given them, has been the source of much discussion. It is easy to push on a straight instrument like a cylinder by making it revolve on its own axis, and thus overcome obstacles which could not with one of another shape have been surmounted. But this advantage is more than counterbalanced by the pressure which their beaks cause against the floor of the membranous and prostatic portions of the urethra, and their tendency to make a false passage. Crooked instruments give less pain, enter better, and are in every respect preferable.

The S shaped catheter of the ancients revived by J. L. Petit, so as not to fatigue the canal so much when permitted to remain in it, has become useless since the addition of flexible ones to our science. A very great and very lengthened curve does no good, and serves to impede the motion of the hand. That curve which is confined to the end of the catheter, as Rameau suggested, and as Mr. Key has since advised, enters more easily than a straight catheter does, but pulls quite as much on the sub-pubic portion of the urethra. The most convenient we have are curved only in the posterior fourth of their length, in such a way as to form an arc whose string is but three or four inches long, and its radius not more than two or three. I have found those most useful, the axis of whose beak is carried to the point of crossing the supposed continuation of their length at a right angle, and especially incises where the prostate is enlarged. The more it projects backwards the more difficult is it for it to enter the bladder, and not butt against the lower wall of the canal after it leaves the perineal aponeurosis. The silver wire which they are supplied with is hardly ever of any use, and has not even the advantage of being able to clear the eyes, or clean the interior of the instrument when stopped up by any foreign body.

Position of the Patient.—In most cases it is a matter of indifference whether the patient be standing up, sitting up, placed upon the edge or foot of the bed, or table, with his legs hanging down or supported, or else lying on his bed as usual. The latter, however, being the most convenient position, is that which is most commonly adopted. Semiflexion of the limbs and separation of the thighs which are recommended are not of much importance, though they give more ease to the operator, and may perhaps contribute to stretch and unplait the urethra. The same remark applies to the state of the head, belly, and chest, all of which should it is said be sedulously relaxed.

Position of the Surgeon.—Unless the surgeon be ambidexter he stands necessarily upon the left side, and can only take his station facing the patient or between his legs, if it is his wish or it be necessary for him to be operated on out of bed. With his left hand half supinated he seizes the sides of the penis between his ring and middle fingers, and with the forefinger and thumb pulls back the prepuce so as to uncover the glans, or at least the meatus. His right holding the catheter, held like a pen, its concavity being towards the abdomen presents its point to the orifice of the urethra perpendicularly, and so carries it on without raising the handle to the bulb, by a see-saw motion, performed from right to left or from the abdomen towards the space between

the thighs, a circular motion in which the two extremities of the catheter seem pursuing one another. He then introduces it into the membranous portion beneath the pubis, causes it to pass the prostate and all the crooked part of the urethra, so that, as it were, it embraces the posterior surface of the symphysis, and its hollow portion is in the axis of the lower strait. Urine flows out directly, and the thumb, opening or closing the orifice of the artificial tube, allows it to flow or be restrained as need may be.

Difficulties in the Operation.—Catheterism is not always thus simple, and by times presents serious difficulties. It is a thing which requires custom and skill, accurate anatomical knowledge, and several precautions. If the beak of the catheter bears too much on the lower wall of the urethra it will glide on with difficulty, and be stopped at the fossa navicularis at the bulbous cavity or in the prostatic depression, and go astray in some one or other of these dilations. These circumstances we need not fear if it be made to follow the upper wall uninterruptedly unless it is raised too much, or unless its axis, instead of corresponding with that of the canal, fall at a greater or less angle on the surface over which it is to pass, and even this improper direction, unless it is excessively out of the way, will have no real inconvenience until between the roots of the corpora cavernosa; and when it arrives at the anterior face of the symphysis all that is required is to pass the catheter along in the axis of the urethra from the meatus to the bladder, holding it gently pressed against its dorsal region. No fixed rule can be given on the subject, because the relations of this axis with that of the body are never constant. In some, the handle of the catheter requires to be held, so to speak, parallel to the walls of the abdomen whilst it is passing through spongy portions of the urethra; whilst in others we are obliged from the commencement to bring it into the plane of the lower strait. Violence however is never necessary. The instrument must progress as much by its own weight as by the influence of any external cause. If we meet with resistance to it, it is to be withdrawn a little way, and then inclined and urged on in another direction. By adopting the advice given by Le Dran and many other authors since, that of drawing back the urethra upon it from below upwards and from behind forwards, we create numerous obstacles instead of doing any away. It is a precaution which can only be useful in the penis portion of the canal. Further on it flattens it, tends to press it against the sub-pubic ligament, and can only facilitate its laceration. The way to enter the bladder safely is to let the catheter descend freely to the commencement of the membranous portion; that is to say, down to the level of the lower edge of the symphysis, so that it may neither depress the upper wall nor lower wall of the urethra against the perineal surface of the horizontal aponeurosis; then suddenly to give it the see-saw motion, though without any effort, depressing the handle from before backwards until it becomes parallel with the axis of the thighs. This movement, unless the beak is on this side of the pubis, carries it at once into the bladder. If not, it butts against the symphysis, the penis bends, and the instrument springs back instead of advancing. This difficulty is generally to the operator's being afraid of depressing the outer end too much, scarcely fancying how very much its point must be raised so as not to be embarrassed by the posterior tubercle of the prostate.

If we encounter difficulty in approaching the symphysis, we are to employ

the left hand in ascertaining the cause by raising the scrotum, exploring the perineum, and trying to detect the beak of the catheter through the canal with the fore and middle fingers, and to follow its movements. If the instrument have gone on a little further the forefinger must be passed into the intestine through the anus. There, as above, acting as a guide and means of exploring, it informs us precisely in what direction the efforts of the other hand are acting; and if we are still in the membranous portion, or in the prostatic, we feel through the thickness of the interposed tissues whether we are likely to create a false passage, and it may even assist us in tilting the catheter towards the bladder. We must however not labor under any error as to the value of this manœuvre, which is in no way applicable to rectilinear catheterism. In raising the prostate the finger increases the curve of the urethra, presses it yet more strongly against the sub-pubic ligament, and naturally offers the soft or lower wall to the beak of the staff.

To derive all possible benefit from it, it is necessary, as soon as the state of parts is recognized and the least effort is about to be made, to draw the pulp of it a little forward, and fix it on the convexity of the instrument at a short distance from its end. By doing this that portion of canal which has yet to be passed over suffers no pressure capable of increasing its curve, and the combined action of both hands is unattended with danger. The signs which show the catheter to have entered the bladder are so evident in most cases that they speak for themselves, and require no description. But in many instances several may be wanting, and the diagnosis be so obscure as to puzzle a surgeon. If thick mucous matters, clots of blood, &c., clog up the eyes of the catheter, urine will not flow out. Instruments which are very much curved keep sometimes so closely applied to the anterior wall of the bladder that they remain motionless and closed even above the upper strait. When the urinary pouch is empty, contracted, or very narrow, we can penetrate to so little depth, and the movements of depression, elevation, and rotation to the right and left of the catheter so limited that one is really led to doubt its having entered, and to be uncertain as to the place it occupies. A considerable mass of blood accumulated in the anterior part of the bladder, which M. Mathieu saw, would be very liable to deceive one, as all the thickness must be penetrated before arriving at the urine. The catheter has besides been known to enter deeply the thickness of the recto-vesical septum, and perform its motions with almost as much freedom as if it had been in the bladder. If a large excavation or adventitious pouch of greater or less size, following an ulceration of the floor of the urethra, become hollowed out in the thickness of the perineum in front of the rectum, of which I saw a remarkable example in a young man who died in 1825 at the hospital of the school, and of which M. Roux says he has seen several, the error becomes still more easy. In fact, the cavity may be mistaken for a diseased bladder, more particularly as the catheter on its entrance gives exit to a small quantity of urine. Hence the sensation of overcoming a resistance beyond the pubis, the freedom that we perceive directly about the deep extremity of the instrument, the possibility of moving it in every way without marked pain to the patient, the road and direction it must have taken, and lastly the issue of urine, prove that we have entered the bladder; but there are circumstances in which many of these signs may be wanting, and others simulate

them more or less completely. If we cannot pass it, after having tried in various ways, it is well to take another instrument with a different curve, either greater or smaller, according to what we think is indicated; or to select one of larger caliber, which by opening and unfolding the canal in a more uniform manner, often passes where a smaller one had been stopped. At other times we succeed better with a catheter of a sensibly less size; or then attempt the use of gumelastic tubes. The position of the patient is to be changed and varied; and when the difficulties which present themselves can no longer be attributed either to the operator or the instrument, we proceed to the examination of such as may arise from the condition of the canal itself. The obstacles chiefly encountered in this part are the following: congenital or acquired tortuosity, deviations resulting from disease, congestions, tumefaction of the mucous membrane or its surrounding tissues, a varicose state of the prostatic plexus, an excessive development of the verumontanum or vesical valve, a fibrous or any other tumor upon the posterior edge of the prostate or trigonal space, and lastly, spasmodic contractions of the perineum and urethra. Some of these are obviated by well-directed motions. The others require to be combatted by different measures. A large bleeding from the arm; leeches between the scrotum and anus; warm baths continued for a long while if the patient is robust and suffers much; opiate draughts; ointments of a similar nature, such as belladonna and hyosciamus placed in the anus, and along the course of the urethra when the irritability is very great, and there can be no doubt that the movements are spasmodic, constitute the series of means to be employed on such occasions. By using judiciously and successively each in its turn, a well informed and skillful surgeon will scarcely ever fail to succeed. If spasm of the urethra, properly so called, really exist, and we can wait for some hours without risk to the patient, it must be treated as I have just described; but in urgent cases every thing must be done to get through it, and I have my doubts whether to a skillful hand it can really form an insurmountable impediment. It is so convenient likewise for clumsy people to assert, as they do, that there is a spasmodic contraction merely because they cannot pass the catheter into the bladder! As a constriction of this sort must necessarily be of short duration, and does not entirely obliterate the canal of the urethra, it must with patience and small instruments be in the power of art to overcome it.

Flexible Catheters.—The urethra is passed with flexible catheters, as by the preceding ones. Still as a general rule it is correct to say that they do not pass so easily as silver ones. If they are to be made to pass a tortuous canal they should have no stylet, so that they may bend freely in every direction. In an opposite case, the caliber is filled up by a metallic rod as strong and smooth as possible. This rod, curved as catheters generally are, becomes the guide of the instrument, should fill it quite to its point, and at its handle end exceed it in length, and generally terminates in a ring. We must be extremely careful that the stylet does not escape through the eyes of the flexible sheath, as it might expose the urethra to a very dangerous injury. It is best before introducing it to give it the proper shape, although it is easy to increase its curvature after it has passed the pubis, by slipping the finger into the rectum. To withdraw the rod we have only to bring it towards the abdomen with the right hand, whilst the left hand holds the catheter below

and pushes it towards the bladder. If this manœuvre is sometimes more painful than the operation itself, it is because it has been badly executed; and never happens when the stylet is made to pass over at its exit the same segment of a circle which it traversed at its entrance.

Some surgeons at the instance of Dr. Hey have approved of the plan of no longer using the stylet after reaching the pubis; but to hold it firmly in one hand while the other makes uniform pressure on the catheter, whose blunt and flexible beak passes better along through the remainder of the urethra, than if it were directed by the stylet. Others, following up an idea of Dr. Physick, use an instrument whose summit is lengthened out in the shape of conical, flexible, and full point, which goes before the stylet. Dr. Hey with a view to fatigue the bladder less, contrived to give the catheter a fixed curve, which many French surgeons have adopted, and whose only inconvenience I think is that of being rather too prominent.

Gumelastic instruments being preferred only in cases in which it is useful to leave them in the bladder, call for the utmost attention of surgeons on this subject. In the first place their composition should be such that no bending can break them, crack them, or destroy the softness and polish of their surface. If this is not attended to they soon become rugous in the urethra, and are soon incrusted with urinary salts; and if, as has often happened unfortunately, a piece falls off into the bladder, every one knows what the consequences will be. The best way of trying them is to make them bend and twist suddenly on their axis. If they resist and do not alter in appearance they may with confidence be employed. If otherwise, they should be refused. The red wax edge which is placed round their free extremity is useful, not only as a groove for the strings which serve to fasten them, but it also prevents them from being lost in the urethra, and from slipping towards the bladder, by escaping suddenly out of the hand. It does not at first sight appear possible for a catheter ten or twelve inches long, left to itself, to enter wholly into the bladder; but of its occurrence we have proofs the most incontestible, and even last year M. Roux was called upon to perform cystotomy for an accident of this kind.

An infinite variety of methods is practised for fastening a catheter in the bladder. Sometimes the ribands which go round the head are led up and fastened to different parts of a T bandage, the two perpendicular branches of which go round the inner surface of the upper parts of the thighs. Sometimes they are attached to a waistband and drawers, at others they are tied to little strings coming from the front of a suspensory, such as is to be met with readily prepared at the bandage makers. Instead of four strings, two up and two down, placed at equal distances from the root of the penis, some have them made with double rows of button holes, others with small rings formed like the handle of a basket. In hospitals the penis is first passed through a hoop covered with linen, which is then fastened by strips of bandage on the front of the pubis and scrotum, so in short as to serve for a common rendezvous for the ribands of the catheter. All these methods are good, in as much as that they make no pressure on the penis; but they all are more or less inconvenient, and have the objection of acting both on the pelvis which is not, and the penis which is movable. The best way after all is to fasten the catheter on the body of the organ itself, which suffers much less indeed than has been asserted when suitable precaution is observed in doing it. With

me the following plan has always been effectual. We take two strips of cotton, rather thick and half a yard long. Cotton wick will answer every purpose. The surgeon makes a simple open knot in each string, places each on the catheter a little below the glands, and then draws the knots close, leaving the four ends separate and pendant. He then takes, adjusts, and approximates the two ends of the first string, passes one end within the other so as to form a loop an inch or two from where they are knotted, applies this loop against the penis; passes the end of the loop round it, crosses them, brings them back again to the side whence they started, and ties them in a bow. He then does the same with the second string; carefully arranging the whole so that there are four strings equally tense having the instrument as an axis or a starting point, and the body of the penis for a basis or termination. As from the suppleness of their tissues, they scarcely irritate the organ, it supports them very well. Instead of one or two turns, we may if necessary pass them several times around the corpora cavernosa, so as in a measure to cover the whole penis from the root of the glands to the pubis, by carrying the cotton wick round often enough. We may also, as M. Roux prefers, previously surround the penis with a piece of fine linen, so that the strings may not be in immediate contact with the skin; but these little changes, as they are matters of choice only, do not deserve discussing seriously. If erection or swelling of the organ obliges us to adopt some other course, any one of those described in the commencement of this paragraph may be pursued. A precaution which it is not less important to attend to is not to keep the catheter in too deep; for though a flexible one it may create inflammation and ulceration of the bladder, and even perforation, of which we possess many examples. On the other side, if its holes are not beyond the prostate, urine will not enter, and the instrument will be useless. It is better upon the whole not to leave more than an inch or two in the interior of the bladder; and to fasten the retentive apparatus near the glands in a relaxed state of the organ and not on the handle or at the extremity, unless it is our wish that the urine should issue guttatim. The catheter thus arranged is stopped up with a little wedge or plug of wood, a sort of spigot which the patient takes out when he feels a desire to urinate, and puts in again directly afterwards. As it does not absolutely interfere with his walking, it is made more comfortable, and kept in more safety by being cautious to have it gently turned up with the penis on the pubis by means of a bandage. Prudence requires that every two, three, or four days it be taken out and cleaned; and that it be changed if it appears in any way altered, which happens every eight, ten, twelve, or fifteen days. By keeping it in longer than this, we run the risk of finding it coated with saline concretions, which may lacerate the urethra as it is withdrawn.

The Masterturn.—In former times lithotomists and great surgeons had a peculiar way of introducing a catheter. To do it they turned its concavity downwards, and brought it towards the abdomen by a semicircular turn, only at the moment of the arrival of its beak beneath the sub-pubic ligament. The remainder of the operation was not different from the preceding; and the perfection of the slight of hand consisted in making the circular turn end insensibly in the tilt upwards, which alone could justify the expression "masterturn," or (*tour de maitre*). It was for a long time supposed that the only object of this method was to conceal the true mecha-

nism of the catheter from the eyes of their assistant, but there is beneath it I think something more than this. The end of the instrument passed in this way executes a rotatory motion in the curved portion of the canal, which must undoubtedly aid its passage beneath the symphysis; and which thereby combines the advantages possessed by straight instruments with those of curved ones. But as it is a delicate attempt, which in every one's hands would not be unattended with danger, it has been generally discountenanced or reserved for a few special cases. An extreme protuberance of abdomen, for instance, and the operation for stone, when we stand facing the patient to introduce the instrument, render it unnecessary. It is not even then indispensable, for there is nothing to prevent us from turning the handle of the sound to one side during the first stage of the operation, if the size of the belly, and the uneasy forced position of the surgeon do not allow of its being directed as usual.

Catheterism in the Female.—The female catheter is but from five to seven inches long and nearly straight. It is generally an exceedingly simple thing to introduce them. The canal through which they have to pass is so short, so regular, so easy to find and to follow, that it scarcely resembles that of the male in any respect. The patient is more conveniently placed when she lies on her back, than when standing up or seated on the edge of her bed. The surgeon, who stands on the right side rather than on the left, desires her to flex her limbs gently, and to separate her thighs. He then places his left hand in supination on the pubis; opens the labia minora with the thumb and middle finger; raises the clitoris and vestibule with the index, the nail of which is kept towards the meatus; takes the catheter previously greased, and holds it in his right hand like a pen; passes it beneath the right ham, if the breech and vulva seem too much sunken; offers the beak with its concavity upwards to the orifice of the urethra, lowers it a little to get it beneath the symphysis; raises it again immediately, and with one effort passes it into the bladder. I shall not here repeat the means for maintaining this instrument in its place, having pointed them out fully in the article on "Vesico Vaginal Fistula." This is an operation so shocking to the delicacy of some women, that we should be happy if it could always be done without exposing their persons. Generally this is possible and even easy. If the left hand being placed as above described, the beak of the catheter is carried to the nail of its forefinger, it is afterwards only necessary to slip it downwards, following the median line on the vestibule, to fall almost certainly upon the meatus. We should be still more certain to succeed by passing the instrument from below upwards, resting its extremity against the pulp of the right middle finger, whilst the ring finger of the same acts as a sort of explorer or sentinel. It easily detects the fourchette, then the entrance, then the anterior column of the vagina, the termination of which more or less swelled like a tubercle, is found immediately below the urethral orifice. At this point the ring finger stops. The others then slip the catheter over its fleshy part, using it as a director. The meatus cannot be more than a line or two off; we feel about a little and almost always easily enter the canal.

In women who have had many children, in old age, and during pregnancy, &c. the urethra is at times pretty difficult to find. It has retreated into the pelvis and behind the pubis and becomes very oblique, or even rises quite

against the symphysis. In such a case, the meatus must be looked for deep under the pubic ligament, and if it does not soon show itself, we try to bring it into view by pulling upon the base of the clitoris and the vestibule upwards, with the index finger, whilst the middle finger and thumb at the same time pull the nymphæ strongly outwards. When the catheter is introduced the handle must be rapidly lowered. We are even obliged sometimes to employ one with a more considerable curve, or even to resort to the male catheter. Even when the points are in an unnatural, distorted condition, as in the few first days following delivery, for instance, if the surgeon will remember that the meatus urinarious is always situated on the edge of the vagina, at the junction of the circumference of the opening of the vulva with the base of the vestibulum, in other words, at the base of the small triangular opening bounding the inner surface of the labia minora and lower surface of the clitoris, he will find that in no case is catheterism really a difficult operation in the female sex. It is rendered more troublesome in early youth, merely by the intractability of the patients. The catheters require to be less thick (say one or two lines) and less long, (say from five to seven or eight inches) but to be prepared, introduced and fastened in the same way as is done in adults, only it is well to have the curve a little longer, because of the symphysis at this age descending lower, the bladder being higher, and the prostate less bulky.

Art. 2.—Strictures.

The means which have been proposed and put in practice, in the treatment of organic contraction of the urethra, are catheterism, forced injections, dilation, cauterization, incision from without inwards, and scarifications.

§ 1. *Catheterism by Force.*

When there exists a complete ischuria, and the obstacle causing it can by no manipulation be done away, either by using a metallic or gumelastic instrument, straight or crooked, hollow or solid, or with bougies of different kinds, and the case is urgent, no choice is any longer left the surgeon, but to perform puncturing the bladder or to effect catheterism by using actual force. This operation had been advised since the time of Dease, and to do it a catheter ending in a trocar point had been employed. Now those persons who venture upon performing it, use a conical instrument suitably curved and very strong. Credit for the idea is given to MM. Desault and Boyer; but Coffiniere, who violently contested their claims, declares that it belongs to him, and that he promulgated it in 1783. According to M. Boyer, M. Roux is the only person in France who has taken up its defence; and except Dr. Physick, who is said by Dorsey to have used a similar practice since 1795, it has found only undervaluers in the surgical world. It has been thought that by thus forcing a way through the impediment, the instrument must make a false passage and tear the canal very much oftener than it could pass the narrow part by violence; and to those who know the dangers which attend urinal infiltration, the idea of such lacerations has been extremely alarming. Nor do I think that it is a point upon which practitioners generally have de-

ceived themselves. In spite of all his skill and all his practice, M. Roux has more than once demonstrated the dangers of his method. I once myself had occasion to open the body and dissect the urethra of a man who had been treated by him in this manner, and who died of urinal abscess caused by a false passage. However, the danger certainly appears to have been exaggerated. A well conducted instrument does not always swerve from the natural course on clearing the resistance. Besides which, when it really ruptures, instead of doing it away and it escapes from the urethra, it generally re-enters it some lines further on. Lastly, supposing it to reach the bladder only after freely ploughing up the body of the prostate, this accident even is far from always proving fatal. The catheter remaining in may change the false passage into an accidental canal, and yet the organism scarcely take notice of it, as I saw in an instance in 1830, at a hospital in Paris. Neither is it uncommon to see the urine resume its course in a few hours, or after some days, through the natural channel; and upon the whole I do not know whether persons sure of their hands and of their anatomical knowledge, so as not to fear to stray in going through the perineum, ought not to prefer forced catheterism with a conical sound to puncturing the bladder.

Method of Operation.—The patient and surgeon take their places as for simple catheterism. The more weighty and solid the instrument is, the better it penetrates. A common catheter exposes us more than any other to lacerate the part, nor will it enter the urethra easily enough unless the cone which it represents be prolonged insensibly up to the handle. Its march would not be progressive enough if it only occupied the vesical extremity; and having once left the canal, it would advance too rapidly into the adjacent tissues. Generally it becomes necessary to make use of force only after leaving the bulb and level of the symphysis. From that time the surgeon with his right hand approaches the glans penis; takes hold of the instrument by its middle, and not its handle, that it may vacillate less, and so that he may with greater ease hold it with all necessary firmness; pushes it accurately onward in the known direction of the urethra, not allowing it to deviate in the least, and only urges it forwards in proportion as the fingers, one or more, of the left hand on the penis or in the anus, follows its motions and can appreciate its progress, and make him certain that the beak scarcely departs from the centre of the membranous and prostatic portions of the canal through which it passes.

False or New Passages.—By tearing the urethra in its bulbous portion, the catheter is liable to plough up the whole extent of the perineum and recto-vesical septum, may even make its way into the intestine before it again finds the canal, and not enter the bladder at all. The false passage consequently is so much the more dangerous as it does not even give exit to the urine.

If the tear has taken place above, and the point of the catheter has got up behind the symphysis and in front of the bladder, the misfortune will be greater still; for infiltration having to attack the pelvic cellular tissue would almost infallibly produce death. False passages through the prostate are infinitely less alarming; 1st, because the tissues of this gland resists the contact of urine, and generally prevents infiltration; 2d, because the instrument not being far away from the organ to be voided, returns to it almost constantly before much damage is done, or a great space outwardly passed over.

As soon as we are conscious of having met with this misfortune, we must, unless it be complete, withdraw the catheter towards ourselves, and do all in our power to find the urethra and re-enter the natural passage; or else if it communicates with the bladder leave the instrument in until such time as it can be replaced by a gumelastic catheter, which must be left in for several days. When infiltration takes place, and swelling and infiltration are beginning, whether the bladder be empty or not, and whether or not it be possible to place an instrument in the urethra, we must not hesitate; we are freely to incise the presumed course of the laceration and to endeavor to get to the canal. It is the only means of limiting the extent of evil, and of preventing mortification of the tissues.

§ 2. *Forced Injections.*

A means which should be tried before paracentesis vesicæ is resorted to, and which is not attended with the same dangers as catheterism by force, is distention of the urethra by a liquid pressed in from before backwards. It was first mentioned by Tyre in 1784, who says that he has derived the greatest advantage from it; and Sœmmering states that if he is unable with the most delicate bougie to pass the stricture, he injects oil into the canal, closes its orifice directly, and presses upon the urethra so as to make the oil pass from before backwards.

Brunninghausen's method is a little different; he, at the moment when the patient attempts to make water, presses upon the urethra strongly behind the glans and compels the fluid to retreat, thinking thereby to overcome the stricture. About ten years ago M. Despiney de Bourg proposed a liquid of a purely emollient nature, which was to be pushed on with a syringe. M. Citadini who in 1826, in the month of March, published a work upon this subject, carries an open catheter down to the impediment, keeps the urethra firmly and closely applied to it, and uses it as a syphon for the injection of tepid water with all necessary force, or of any other appropriate fluid into the canal. M. Amussat, who believed himself to have invented forced injections, does very much as M. Citadini. He advises the application of a compress around the penis, so that no void may remain between the catheter and the parietes of the urethra; then that a bottle made of caoutchouc, filled with water, be adapted to the top of the catheter, and that the injection be thrown in by compressing the gumelastic bag with a tourniquet. But it is very clear that, if the principle be but established, it can be of very little consequence whether the liquid be projected by a syringe, gumelastic bag, the fingers, or in any other way. This method, though a rational one, and one which in certain cases is of undoubted efficacy, is still far from deserving all the praise which some persons have lavished upon it.

If the urine, which is a kind of natural injection flowing from behind forwards, neither can break through the stricture, cause it to disappear, or prevent its occurrence, how can we hope that any fluid whatever, merely because it is forced in an opposite direction, should triumph over every obstacle? It is therefore very probable that the success which is attributed to it, may have resulted from the use of catheters and bougies directed judiciously; and that in a majority of instances injections might have been

rendered unnecessary, by a most skillful employment of the ordinary means. Still as it is easy to use them, and they are attended with no inconvenience, I see no reason why they may not be essayed, even without waiting for the failure of other methods.

§ 3. *Incisions or Scarifications of the strictured part.*

Although a very old one, the idea of carrying down a cutting instrument to the bottom of the urethra, to destroy its contraction, has never had many advocates; and I wonder that it should ever have been attempted to revive the practice in our own time. Besides the almost utter inability to cut nothing but the strictured part, the danger of cutting healthy and not diseased structure, and the dread which the patient must feel, another inconvenience about the method is, that it offers no chance of a permanent cure, and that it renders the stricture, after the little wounds have healed, tighter than it was before. In fact, one of two things must happen; either we must leave the canal to itself after the incision, and in this case the wound having to heal by first intention will be closed at the end of four days, or else it must be kept open by means of catheters and bougies, and then we shall have mediate cicatrization. Now it is actually demonstrated that these secondary cicatrices, when left at liberty, contract invincibly upon themselves, leaving the stricture in just the same state in which the knife found it, if it be not even much harder, and much more difficult either to overcome or to destroy. The facts which are arrayed against this reasoning, prove nothing; because, supposing them to be true, the dilation which is called in to aid the incision, is of itself sufficient to explain the success which is obtained. But more than this, most generally the incision has not even touched the stricture, and of course if it seems to give way directly, it is because of the effect of the dilator instruments, which urethrotomists never fail to pass immediately. Practice daily furnishes evidence that after the incision, relapses follow as after simple dilation. I have beneath my eye, at this very time, two remarkable instances of this, who have been cut each of them twice, at an interval of a year, by one of the most ardent and presuming scarifiers in Paris. It is a method which can do only for frænum, vulvular, or semilunar strictures, if any should be met with in the anterior third of the urethra; but which beyond the bulb will be attempted only by the inconsiderate, who are wanting in accurate surgical or anatomical knowledge—only empirics.

The Method of Operation.—As it is possible that there will be some who, notwithstanding the above remarks, will continue to practice incisions, and as likewise they may become necessary in certain cases of well defined stricture, too hard and too thick to yield to the distending efforts of a bougie, I shall describe the method of doing it.

Dorner, to whom the credit of it is given by Siebold and Sœmmering, advises the use of a sort of lancet, passed through a catheter. Dr. Physick highly recommends an instrument of the same kind, a stem ending in a fleam point, enclosed in a canula of sufficient length, of which it is forced out by pressure on its free extremity. In the work of Dr. Dorsey, two of these urethrotomes may be seen; one of which has no curve whatever, being intended for strictures of the straight portion of the canal; the other rather more curved near its beak

than a female catheter, so as to be adapted for attacking strictures of the bulb and the membranous portion. Dr. Randolph assures us that Dr. Gibson has succeeded with it in cases in which no other method could have been successful. But every one must see that the cutting edge of either Dr. Physick's instrument or that of Dorner, no matter how skillfully used, will enter more often into the thickness of the canal than into the middle of the obstacle, and in many cases will leave the stricture wholly untouched. Dr. Despinay, who approves of incisions only in cases of contractions of the urethra of a bridle shape, in its anterior part, about the fossa navicularis for example, advises that they should be executed with a straight, very narrow, and probe-pointed bistoury. The object can evidently be better accomplished by the bistoury contrived by Bienaise or M. Civiales' small sheathed urethrotome. The advantages of this plan of operating over that pursued by Dr. Physick no one can dispute. The incision being made by a lateral effort, and from behind forwards, gives rise to no exposure to a false passage, as that one does which is made from before backwards, beyond the conducting instrument. Dr. Ashmead acting upon the same idea as M. Despinay de Bourg, has had an instrument made which is a concealed bistoury like that of Brother Come, the sheath of which extends to a point, blunt or buttoned, to go through the impediment; its blade cutting only for an extent of six or eight lines near its extremity, so that when it is opened it incises only the strictured part, which is thought by its inventor adapted for any region of the urethra. Others, M. Dzondi first, and afterwards M. Amussat, have contrived a sort of drill with four, six, or eight cutting edges, or crista, parallel to its axis, projecting for half a line, or a line at most, on the circumference of its vesical end, which for a distance of six or eight lines should be somewhat enlarged. The intermediate grooves are filled up with tallow. It is enclosed in a straight canula, by which we are enabled to carry it down upon the obstacle. When it reaches this part we begin to push; it quits its canula and enters the stricture. The tallow either melts or is pushed back by the resistance. The little edges stand out isolated, and cut the constricted circle, like scarificators, in different directions. Then it is drawn out, a catheter or flexible bougie immediately enters its place, and is left in for twenty-four hours at least, and renewed from time to time until the cure is accomplished. In order that such an instrument may penetrate, the stricture must not be complete, for the beak which does not cut, and which has to pass first, is nearly two lines thick; of course the introduction of a pretty strong bougie cannot be very difficult, and we seek in vain for any justification for the performance of urethrotomy. The same reproach lies against Dr. Ashmead's instrument and M. Despinay's procedure; but with this difference, however, that as it may assume the form of a bougie, or a stylet, the latter urethrotome will traverse the impediment after the manner of a catheter and will only divide it secondarily by an after stroke. It combines the qualities of an urethrotome with that of a conducting catheter, or a bougie for dilation; it can bear upon one point only, or it may cut several successively, and at different depths, at the pleasure of the operator.

It is this instrument consequently which answers best, whenever it is absolutely requisite to practise this method of incision.

§ 4. *Concentric or External Incisions.*

Strictures of the urethra occur so frequently and give rise to accidents of so serious a nature, that the genius of surgeons is untiringly employed to discover some remedy, and the most dangerous and painful methods have been proposed for their removal. Planque has given us the case of a surgeon who fearlessly opened an urethra from one end to the other, so as to cauterize and cleanse its interior, which he after re-united by means of several twisted sutures, upon a catheter, and cured his patient; which in Solingen's time was the method in use at Livourne. Instead of thus dividing its entire length, many surgeons determined upon merely incising the strictured part. J. L. Petit, an advocate of this method, permitted the wound to heal upon his S shaped catheter, whilst, according to what M. Dolivera says, Lassus after a similar operation replaced by a gumelastic catheter in 1786. M. Levamier of Cherbourg, who was stopped by an almost entire obliteration of the canal, fearlessly revived the procedure of Petit and Lassus, and his boldness was crowned with complete success. But that in our own time several surgeons had chosen to adopt the same operation, and had striven to renew the popularity of a method in France almost forgotten, a few words of mention would have sufficed for it. But for some years past it has been too often attempted for me to pass it by in silence.

The Method of Operation.—MM. Eckstrom in Germany, Arnott in England, and Dr. Jameson in America, who have derived marked advantages from the operation, perform incision of the urethra according to the following rules: A staff or catheter with a groove in it, is passed down to the obstacle and held there by an assistant; the surgeon raises the testicles and stretches the parts with his left hand; makes with his right a large slit *(buttonhole)* on the perineal wall of the passage with a very sharp bistoury; strikes upon the staff; withdraws it a little, then endeavors to find the continuation of the urethra at the bottom of the wound, at the same time that the patient makes an effort to urinate; attempts to pass into it a stylet or grooved staff, which he uses as a director on which to extend the incision backwards for a distance of some lines beyond the stricture; and he concludes the operation by leaving a catheter in the canal as far as the bladder, upon which catheter the wound speedily heals.

Where the obliteration is very complete, or it is very difficult to discover the opening, we are advised by M. Groninger to cut at random almost as far as the prostate; to plunge either a narrow bistoury or a trocar through this gland into the bladder, so as to create an artificial canal, afterwards to be kept open by passing into it through the meatus urinarius a catheter to be left in, on which the wound is to heal. Mr. Cox, who advises the same thing, quotes a case in support of it which he looks upon as quite conclusive, but which in fact merely shows how far the rashness or blindness of some surgeons may be carried. In fact the urethra is never completely closed in an organic stricture. Even supposing that the simple slit be sometimes indispensably necessary, and that forced catheterism should not receive a preference over it, when passing a bougie becomes absolutely impossible, it may at least be as-

serted that such an incision as this ought always to be sufficient to enable any well informed man to discover the continuation of the canal. It would assuredly be much easier, more rapid, and less dangerous to puncture the bladder, than perform the operation advised by MM. Gwneger and Cox, and twenty times less painful. Besides, I doubt very much whether any French practitioner of the present day will find it necessary to imitate this conduct, and even whether they will not constantly avoid making even the simple slit in the perineum.

§ 5.—*Dilation.*

The treatment of stricture of the urethra by dilation, is the oldest of which we possess any knowledge, and for a long time was the only one in use. Leaden bougies formerly used and cried up as new some years ago by M. Horzberg; those made by Schmidt of a composition consisting of an alloy of tin and lead, although very flexible, were too hard and weighty to be borne by the urethra without inconvenience. Bougies made of wax and of gum-elastic have alone been retained in practice.

The former of these instruments were formerly constructed of several substances, and were particularly extolled in 1551 by Lamna, and by Daran in 1745, under the name of *emplastic* bougies. Since the possession of medicinal virtues has been denied them, and that they have been esteemed on account of their mechanical properties only, red, white, or yellow wax made flexible, has been substituted for the various component compositions of a resolvent, astringent, or desiccative nature. The only qualification now looked for in them is that of suppleness, softness, an inability to melt in the organs, a capability of moulding themselves to every inflexion of the canal, and an absence of all brittleness whatever. The leaden wire by some persons introduced into their centre to add to their solidity is useless. A delicate and slender piece of cat-gut is better, if we are absolutely determined not to use those which are made of emplastic cloth. The second variety, the gumelastic bougie, which is more soft, supple, and flexible, and still less irritating than a wax one, has the inconvenience of distressing the urethra more by its very elasticity, and its disposition to straighten, particularly if it be of any size; whence it follows that as mechanical agents they cannot be substituted in every particular for emplastic or sear cloth ones, as Sœmmering and most authors of modern times have asserted. Each is met with under various shapes. Some are cylindrical, some swelled, some conical, &c. Conical bougies grow larger as they penetrate, and therefore are advantageous in dilating the canal more rapidly and not bending up as readily in it; but they have the disadvantage on the other hand to tend to escape from it; to fill it up too accurately, and consequently to distress it much towards its base; moreover, if the instruments are too long they project into the bladder before they act suitably upon the strictured part. It is necessary that their point, beginning very thin, should not be more than twelve or eighteen lines from the body of the cone, and that they should afterwards be cylindrical up to their head; it being remembered that no bougies below Nos. 8 or 6 require this modification, which would enfeeble them to no purpose.

The bougie a *ventre*, or which bellies or swells out, will often deserve a

preference. The fusiform (spindle-shaped) enlargement of its posterior fifth when it is long enough, is no obstacle to its being made conical on that side, and the sensibly less considerable bulk of its stem, causes it to concentrate almost all its efforts upon the stricture, distress the urethra very little, and to be kept in without any difficulty. Led by this idea, M. Desruelles has proposed to substitute for a bougie a metallic canula an inch or two long, to be left in the strictured part, after being carried down by the assistance of another instrument, and so as to be kept outwards by means of a string. But the swelled bougie is better; it allows us to carry the dilation to any extent we will, and gives less pain than conical instruments.

The mode of action of bougies upon stricture has not always been viewed in the same light. It is now only conceded that they cause ulceration and dilation. This must evidently be erroneous. The eccentric compression which they cause, bringing about interstitial absorption, may, whilst it distends and obliterates strictures in the urethra, remove the phlogosis which so often keeps up their existence. The radical cure which they produce, oftener than from the testimony of some authors, one would be inclined to believe is indeed explicable only by this remarkable fact. This leads us moreover to think that medicated bougies have probably been wrongly rejected entirely, and that their topical action is perhaps not so despicable as it has not been well understood.

Ulceration.—Those who have adopted the method of ulceration, rest their argument on this ground, to wit: a stricture which is merely dilated cannot fail to return as soon as the use of the dilating agent is dispensed with; whereas, if you do induce a loss of substance, you must obtain a permanent enlargement of the canal. Home recently, in professing a similar doctrine, has committed a double error. In the first place relapse is not inevitable after dilation; in the next, ulceration induces a loss of substance whose very cicatrization will reproduce stricture with much greater certainty. There is moreover nothing to prove that it really can be produced at will. A bougie forcibly introduced into the *infundibulum* of a stricture, or pressed down on the centre of the circular constriction, irritates and dilates sooner, but does not ulcerate and rather excoriates the part.

Dilation.—The medicinal effect of bougies, to which we shall probably at some future day return, being for the present laid aside, the only thing of importance to be studied is their effect of distension in its different degrees or under its different aspects. It is a sure and almost an unfailing effect, and yet attended with the serious inconvenience of being kept up with unequal constancy, and of acting merely as a palliative to the evil instead of curing it radically in most of the patients who submit to it.

Still to these objections it may be replied that their weight has been overrated; that strictures which consist neither of frena nor valves, nor salient cicatrices, nor of vegetations of any kind whatsoever, but which depend on pure and simple thickening or phlegmasia of the mucous membrane and subjacent organic layer, sometimes yield beneath a well-directed dilation; and lastly, that it suffices, in order to guard against relapses, to pass a bougie at first every month, then every two months, three or four months, and keep it in for some hours; a precaution which must be the less annoying to the patient as he can do it very well for himself.

Method of Operation.—In a firm stricture, passing a bougie is not always an easy matter. If it is too fine it bends up before the least obstacle. It is easier for it to pass if it be somewhat larger. Cat-gut ones, which are stiffer and possess more strength in a small compass, here offer some advantages. M. Delpech advises us to flatten and chew the point a little so as to change it into a sort of supple and delicate pencil; he then passes it through the obstacle, takes it out at the end of two hours, carries in a larger one, which he removes after a like interval and puts in another, and on the same evening, if he thinks it practicable, replaces that by a bougie or gumelastic catheter. The swelling of which they are susceptible makes them in such a case dilators of precious value; but as they untwist, soften, and grow knotty, if we delay changing for more than two or three hours, we run some risk of their breaking or scraping the urethra.

Small Catheters. Hollow Bougies.—It is also frequently most convenient to begin with a very small catheter or a hollow bougie. The stylet with which it is provided should be well curved up to the beak, and as strong as possible. The whole is then introduced into the bladder according to the rules of catheterism. Besides which it is prudent to be provided with catheters, bougies, and cat-gut bougies in one's case, so as to be prepared to try them one after the other if it be necessary. For the patient there can be no fixed position. Sometimes he must be allowed to stand up, sometimes to sit down, and sometimes to lie horizontally upon the bed. The penis, which in general is raised, requires in other cases to be slightly lowered and drawn forward. The patient, guided by the sensation he experiences and the resistance with which he meets, will succeed sometimes where the most skillful surgeon had failed. The want of success in a first attempt is no argument against its renewal. A thousand peculiarities, of which practice alone can make us aware, may oppose themselves to our success at first, and permit it in a moment afterwards. Upon the whole the procedure is very much the same as that for performing catheterism. The penis is held in the left hand, the bougie is pushed on with the right. The most delicate instruments most readily catch on the bottom of the lacunæ of Morgagni, or of the slightest plait in the canal. The moment that any resistance is felt, the bougie is to be turned as an axis between the fingers after having been withdrawn a few lines, and is again to be pushed onwards (as it is being turned) to the obstacle. A cul-de-sac, a fold, a wrong direction, a rugosity, an elevation caused by the stricture itself, may arrest its progress. It is then particularly that it must be made to advance gently; it must be drawn towards the operator; its inclination is to be varied; it is to be turned round in the fingers and its advance favored by means of the fore-finger applied to the perineum. It is known to have entered the stricture when, not advancing further, it shows no disposition to recede and seems to be compressed at its point, as it were. We may be very sure of the reverse, so long as it springs back on relaxing the pressure, and offers no resistance to any attempt to withdraw it. A person of experience will never be deceived, and will feel better than he can describe the difference which there is between a bougie which has engaged in a stricture, and one which is merely stopped in the urethra.

In the former case, the excess of its bulk alone preventing its passing, we have but to replace it by a smaller one, or else fasten it at the point at which

it has entered. In the second, the attempt is to be renewed in every possible way, by taking bougies of larger and smaller size, and of different forms and shapes. As a last resource, the bougie may be fastened at that part of the urethra to which it has descended, provided its extremity be not turned up into a sort of brush. It is by no means an impossible thing that by so doing it may of itself clear the obstacle; and that in half an hour's time nothing may be easier than to make it advance considerably. This conduct which has been for a long time pursued at the Hotel Dieu, at Paris, has produced numerous and oftentimes unexpected instances of success. If the canal appears to be too much irritated, too painful, if it bleeds abundantly or is spasmodically contracted, we must suspend the operation and return to it again when these symptoms shall have subsided. Emplastic bougies previously curved at the point can, it is true, be no longer rolled between the fingers; but they accommodate themselves better to the direction of parts, and in certain cases overcome obstacles which had resisted all the others. That which seemed to be impossible, is sometimes rendered easy by bathing the penis in cold water; warming the instrument before it is introduced; besmearing it with cerate moistened with oil; or by charging it with some ointment containing opium or belladonna. A long probe-pointed stylet, having a ring at the other end, introduced by a rotatory motion, has succeeded with me in many difficult cases quite as well as with MM. C. Bell and Vanvelsuner, who proposed it in 1814 and 1821. The button at its end is an excellent means of clearing the most irregular strictures, and as M. Segalas has pointed out, it allows the extent of the contraction to be measured.

I now suppose the bougie to be introduced. To fasten it in, it is only necessary, when it is an emplastic and swelled one, to bend the end near the glans penis in the form of a hook, or of a ring. When cylindrical or merely conical it must moreover be capped by a *condon*, or bag of fine linen, which encloses the penis at the same time. Elastic bougies require similar precautions to those given when we were speaking of catheters permitted to remain in the urethra.

The time which the former are to be allowed to remain in, varies according to a variety of circumstances; according to the sensibility and irritability of the canal; to its being otherwise healthy or diseased; to the degree of suffering experienced by the person; to the date and state of the stricture, whether old or recent, slight or serious; and lastly, to the effect which it is intended to produce. It is rare, however, for it to be less than half an hour, one or two hours, or more than twelve or eighteen hours, which is usually about as long as the patient can endure it without too much suffering. If the want of making water is very acutely felt, and the urine cannot escape between the walls of the urethra and the foreign body, conical bougies have this advantage more, that by withdrawing them a little the urine passes easily, and they can be replaced with facility at the same distance which they were at before. Flexible catheters, either conical or cylindrical, are valuable in this respect, for it is not necessary to change them so as to allow the bladder to be voided, and there are persons who cannot retain their urine for more than an hour, or even as long.

Neither can there be any more certainty as to the time of each application. We are sometimes obliged to wait two or three days, whilst in other cases the

organism gets so rapidly accustomed to it and the patient is so little inconvenienced, that it may be repeated next day. At each new introduction, we employ an instrument of rather larger size, as soon as that last used begins to traverse the urethra freely; but conical bougies being thicker the deeper they are made to penetrate, do not so absolutely demand this change. As the cure progresses, the sittings approximate and are made to last longer. As a principle, it may be asserted that every stricture which may be traversed by a bougie, however delicate, is curable by dilation. The treatment, which is prolonged always in proportion to the hardness and resistance of the stricture, the susceptibility of the patient to impressions, and the facility with which he may be managed, is sometimes not concluded until the end of two or three months; but I am certain from an ample experience of facts that we may, in most persons, at the end of twenty days or a month, succeed in restoring the canal to its natural dimensions, particularly by the use of conical bougies. I have even succeeded in obtaining such dilations in the space of six, eight, twelve or fifteen days, in patients whose strictures had lasted for years; and in some also who had been previously treated either by caustic or bougies, but in whom the cure had remained incomplete. I have no faith in the danger to which it is said to be liable, or in the pain which by some authors it is said to produce. Skillfully applied, I have never seen a serious accident result from its use. The mucous or blenorrhagic oozing which it sometimes induces, almost always disappears of itself after continuing some days.

The fever preceded by rigors and ending in perspiration, like an intermittent, which is caused in certain cases, has in it nothing alarming. The nervous sensations, engorgement of the testes and chord, are occasional occurrences, which are no oftener caused by using bougies than by simple catheterism. A patient, however, whom I performed it upon at La Pitie was attacked with symptoms which it is proper to relate. After several attempts, a conical bougie had been passed. One morning this man was attempting to replace it of his own accord, in which he could not succeed, and made his urethra bleed. An attack of fever which had attended the first trials, recurred, lasted for three days, and yielded on the fourth, to be succeeded by a most violent and painful arthritis of the right tibio-tarsal articulation, in which a prodigious abscess formed, and afterwards anchylosis. This leg had been fractured above the malleoli about six weeks before. Is this a coincidence? or is it an effect of the same kind as that which blenorrhagia often produces?

The only real reproach which a bougie deserves is this: relapses may follow its use; and we are obliged, therefore, to carry the dilation beyond the normal dimensions of the urethra, not to abandon bougies suddenly, and to continue to introduce them from time to time for at least several months.

An air dilator may be formed of a little fusiform, or a cylindrical bag supported by a stylet and carried through a flexible tube, which is to be introduced flaccid into the stricture, and afterwards inflated with the breath; which Ducamp says ought to supersede the swelled bougie, and offers the important advantage of distending the stricture powerfully without at all acting upon the rest of the passage.

We now however know that this statement is not correct; that the little bladder necessarily moulds itself upon the urethra, and presses quite as much

on either side of it, as upon the stricture itself. Mr. Arnott's dilator is not in reality any better. M. Castallat showed me another one which consists of a long canal of fine linen, which is passed down into the bottom of the urethra by a long flexible stylet. This tube, which ends in a cul-de-sac at its vesical end and is open and burnished with a ferrule at the other, is intended to receive little portions of lint or cotton, which are crowded down into the stricture by means of another stem, so as to obtain a dilation as rapid and as gradual as may be desired. However great the ingenuity of these contrivances may be, I doubt whether they will preserve a place in practice. Bougies will, with scarce an exception, allow the same end to be accomplished, and by their simplicity deserve that preference which, in all probability, will always be shown them.

§ 6. *Cauterization.*

Under the belief that strictures of the urethra depended upon vegetations and fungus growths, surgeons, about the 15th, 16th, and 17th centuries, acquired the habit of treating them by caustic. Verdigris, vitriol, savin, &c., mixed up with emplastic compositions, and made into bougies, were employed for this purpose. Ferri, Ambrose Pare, F. de Hilden, Rivere, &c., speak of it as a very general method, and often dangerous, and it is well known that Loyseau was bold enough to practice it upon king Henry IV. In the last century, however, it was scarcely employed, and but for the improvements made in it by Lemonnier, Wiseman, Roncali, Hunter, Sir Ev. Home, Arnott, Ducamp, and several other practioners in France, this method, which ultimately became general, might without any great loss have remained in the oblivion into which it had fallen. The use of the nitrate of silver, instead of sublimate and other caustics originally employed, seems to have removed its dangers and has procured for it the suffrages of many. Since then the demonstration of the possibility of touching only the diseased part has so completely satisfied men's minds as to render the practice, in a measure, a common one. It would, however, be incorrect to suppose Ducamp the original author of these changes. Bougies for taking an impression of the stricture were used as early as the 16th century. F. Germain and L. Mazell expressly recommend that the seat and form of the stricture be ascertained by the beak of an emplastic bougie; that it be withdrawn and that a layer be removed from its point, for which a caustic material is to be substituted, and then that it be carried down again, thus *armed*, into the strictured canal. The procedure of Sir E. Home, which consists in fastening a fragment of lunar caustic upon the point of a bougie for the purpose of passing it down to the stricture, evidently differs a little from that of Germain or Mazell. In like manner A. Pare anticipated John Hunter in inventing a canula for protecting the canal, whilst the bougie armed with the caustic is being introduced and allowed to act. As it is remarked by M. Dezeimeris, Lemonnier was also acquainted with the method of seeking for the impediment, and taking an impression of it in wax, before proceeding to apply caustic to it. F. Roncalli moreover had employed the very same caustic as Hunter, or the same procedure as Pare, ever since the year 1720; and the practice of Wiseman was so far from being given up, at the period of the experiments of his countrymen, that in 1755

Allies complained of its proving so frequently fatal at Paris. In spite of the remarks and modifications of MM. Aberdom and Wathely, the method of Sir E. Home, adopted in France in 1818 by Petit, was so violently opposed by Rawley and Carlisle, amongst others, that even in England it labored under powerful prejudices. The work of Mr. Arnott in 1819, founded upon principles similar to that of Ducamp, produced scarcely any sensation in London; any more than that of M. McIlvain, published in 1830, will do towards establishing the use of potassa.

Cauterization from *before backwards*, with or without a protecting canula, has, since MM. Arnott and Ducamp made their method known, almost entirely disappeared from practice. If any should still be disposed to attempt it, the armed bougie invented by Messrs. Home and A. Petit being flexible, ought to be preferred for strictures near and beyond the bulb. If it be pushed forward rapidly, it is difficult for the caustic which occupies its beak to touch the walls of the urethra before it comes to the funnel-shaped constriction; it is then pressed down, a little of the nitrate melts, and in about a minute it is withdrawn. When the obstacle is not so deeply situated, Roncalli's or Hunter's canula may be employed without inconvenience. Mr. Chas. Bell and Mr. Shaw thought that the beak of a metallic catheter, curved or straight as the case might be, with a central aperture if the obstacle is central, if lateral an opening on one side, would answer the indication better by giving an opportunity of carrying down a piece of caustic and projecting through one of these holes, either with a bougie, a long forked stylet, on any other appropriate instrument.

Lanteral Cauterization, which has lately attracted so much attention, requires more caution and is performed by divers procedures, all belonging to the same method. The apparatus of Ducamp for this purpose, consists, 1st, of an *exploring* catheter, made of gumelastic and graduated, which is intended to ascertain the depth at which the impediment exists; 2d, of a bougie for taking an impression, which is another graduated stem, having a certain quantity of ductile wax at its extremity; 3d, of a *conducting* catheter, also graduated and flexible, fitted at one end with a platinum socket, and enclosed in a silver tube at the other; 4th, of a *caustic holder*, consisting of a small platinum cylinder, having a slit hollowed out upon one of its faces, a transverse pin towards its root, so as to prevent it from going beyond the beak of the conductor, and also a flexible stem with which it screws, and which is continuous on the other side with a metallic stylet armed with a ring.

The Method of Operation.—The positions of the patient and the surgeon are the same as for catheterism or the application of bougies. The little platinum cup is filled with fragments of caustic before it is screwed upon the flexible stem. Holding it then in the grasp of a good pair of forceps, it is placed over a candle or a wax light, the flame of which is steady, so as slowly to melt the caustic, and not allow it to swell up, which happens when it is heated too rapidly, or when the cup has not been cleaned or dried. It then remains only to make the whole smooth by removing the roughnesses and elevations which may have formed upon it with pumice stone, or the edge of some cutting instrument. We are then ready to begin the operation, after having accurately determined with the exploring instrument the depth at

which the obstacle is to be found. The first thing to be introduced is the *impress* bougie. It is held firmly for a moment against the stricture; the wax melts, fills it, and enters the narrow part. It is withdrawn and the size of its lengthened point gives the measure of the diameter to be gone through, whilst the cast on the wax should show whether the stricture is central, circular, or if not, in what part of the urethra it exists. We then pass down the conductor to the same depth, where it is kept fixed with the left hand; then we take hold of the ring of the caustic holder in our right hand, and push it in such a way as to make the platinum cylinder loaded with nitrate pass out, by turning the cup towards the diseased side; in a word, by making it enter the diseased circumference. The wings of its pin stop within the socket of the conductor. It is left for a minute, or only half a minute, in contact with the tissues. Having drawn it back again into the catheter, we withdraw the whole apparatus and the operation is at an end. By this procedure, if there be more than one stricture existing simultaneously, we cannot attack that which is farthest off, until we have successively destroyed all the others. The porte-caustique being straight and supported by a very feeble flexible stem, it is both dangerous and difficult to enter the curved portion of the urethra. Besides which, the fluids secreted by the organ very often dissolves the nitrate before it can enter the stricture.

One of the first persons who endeavored to do away these inconveniences was M. Lallemand. His caustic holder, which ended in a knob or button of but one piece, with the stem which makes it move, is straight or curved according as it is intended to penetrate a less way or very deep, and is enclosed in a sheath or catheter of platinum, having the same direction and more diameter than is necessary for it to apply itself accurately upon the cylindrical or swelled portion of the stylet. A sliding ring, armed with a press screw, embraces the conducting catheter or sheath. The stylet has at its other end a lenticular button or a nut, which is not put on until after the instrument has been introduced from behind forwards into its sheath or canula. In drawing it towards one's self, the small enlargement at its head completely closes the beak, and makes the vesical end of the catheter a blunt point. It is carried thus closed as an explorer into the *bladder*, so that we may be certain whether there is or is not more than one stricture. If there be several, we may begin with the last as well as with the first, and either apply the caustic from behind forwards, or *vice versa*, to one after the other, or all at one sitting. When it is placed in contact with the first stricture, the sliding ring is pushed down to the meatus, so as not to lose sight of the distance of the stricture. By drawing the sheath towards one's self, the cup of the stylet is disengaged, and falls covered upon the altered tissue. To close and withdraw it, to push it forward or bring it back to the other strictures, it is nearly indifferent whether we move the sheath upon the stylet, or the stylet upon the sheath, by pushing the one or by drawing back the other. In this apparatus it is necessary to have several stylets, if it be a curved instrument; because, being wholly metallic, they cannot turn upon their axis within the canula, and their *cuvette* or cup necessarily faces a fixed point. We must have them, therefore, with cups on their concave edge, others with the cup inferior, and others again in which it is placed laterally. They must also be of different dimensions, with sheaths likewise of various caliber.

M. Segalas, wishing to preserve the advantages possessed by the instrument of the professor at Montpelier, without relinquishing those in Ducamp's apparatus, uses a stylet composed of small chains at its deep part, resembling the lithotritor of M. Pravaz, which easily performs all the necessary rotatory motions, and can turn its cup to all the different points of the diseased circle successively. He encloses it, armed with its sheath, in the conducting catheter of Ducamp, so as to enable it to penetrate to the first stricture.

M. Pasquier has caused a rim of a circular shape to be placed behind the cuvette or cup of the porte-caustique instead of a pin; so that it might not be necessary to turn the stylet containing the caustic and conducting tube at the same time, as in the instrument of Ducamp. Some other modifications have been adopted by this surgeon, which being of trifling importance, may be retained or rejected with indifference. Among others, he has done away with the bougies for taking impressions, used in the primitive method, and with the exploring bougie; and prefers, according to M. Racine, to commence the treatment by the common bougie and by dilation, so that the caustic may be applied first upon the stricture which is furthest off. Some persons have thought that the stylet might be made of still easier management by lengthening its outer extremity—which is of metal—by cutting it angularly instead of its being circular, so that the pressure screw of the open orifice of the conducting canula may the better adapt itself to it; and have attempted to do away with the need of this screw, by terminating the stylet in a forceps head, one of whose branches is free, and provided with transverse grooves which fasten it conveniently in the square opening of the wide end of the sheath, whilst the other is continuous with the stylet itself; nor have I thought these slight alterations were to be altogether despised.

The *stylet to which I give the preference*, without however attaching any great importance to it, is made of silver, with a platinum cup, has no rim, and has a button at the end like M. Lallemand's. Its free extremity is a sort of watch-spring, from twelve to fifteen lines long; it fits into the immovable branch of the forceps head I just spoke of, in such a way as to be held there by a pressure-screw, or to be withdrawn at pleasure. Its sheath is the same as the flexible canula of Ducamp, in which I do not enclose it from behind forwards, until I have curved it like the stylet of gumelastic catheter, when I think it necessary. The forceps head being placed in, we have only to pull upon it to close the instrument; and then to apply the button or knob at its cauterizing end over the deep opening of the conducting canula. Its flexibility permits me by curving it before the operation to turn the cup upwards, downwards, or on one side. Its head prevents it from making a false passage, and protects the caustic against the moisture of the canal. To make it advance, it is sufficient to approximate the two branches of the forceps head with the thumb and fore-finger of the right hand, to pass that which is free by the side of the other into the wide orifice of the canula, and push them on together whilst the left hand holds the instrument firm in the penis.

Estimate of the Method.—The principal defenders of the cauterizing of strictures lay great stress upon the need of determining, in a mathematical manner, not the depth merely, but the length, shape, thickness, and situation of the stricture. About the first of these points there can be no difficulty.

Any blunt instrument will answer the purpose and give as much information as the explorer or impression bougie of Ducamp.

It is not so, however, with the second point. The emplastic or gumelastic bougie, pointed with doctile wax, which the same writer advised to be passed down upon all the strictures at once, with the idea of getting several casts at one time, is of not the least use whatever. A long stylet with a cylindrical head is of infinitely more certainty. This is passed down to the obstacle either bare or enclosed in a blunt catheter like the common stylet. The figure which then corresponds with the meatus urinarius is noted, unless the meatus be at the top of the catheter. It overcomes the stricture, which, however, impedes its exit a little, by which mechanism it becomes very easy to measure its extent, for the point of departure and that of its return outwardly may both be marked.

To settle its thickness and shape gives more trouble. Ducamp's impression bougie is a deceitful instrument which deserves to have no reliance placed upon it, and is fit only to serve the purposes of empiricism and imposture. When it gets into the urethra, the wax yields as readily beneath the action of a fold, a spasm, or a momentary flattening of the canal, as beneath that of a true stricture, and I have never known a practitioner of distinction who dared to use the nitrate of silver upon no other authority than this. How many urethras have been needlessly cauterized, because of supposed constrictions, originating in Ducamp's bougie being withdrawn distorted in shape? M. Pasquier was therefore quite right in proscribing it, and I think it is an instrument which should be banished from surgery. M. Amussat has proposed as a substitute for it a straight canula, which has a stylet, whose end has a head which is nail-shaped, or of the shape of a lentil. This head closes the opening and forms the beak of the instrument, but is so arranged that the handle is inserted a little without the centre of the terminating plate. When the canula is in its place, it is held or caused to be held motionless with one hand; and the stylet pushed forward with the other. The rasp clears the obstacle, it is turned upon its axis; immediately its cutting edge passes laterally the level of the sheath; on being withdrawn, it rakes the corresponding wall of the urethra, which, if it meets with nothing, must be in a sound state; on the contrary, if it encounters a frenum, a projection, or the morbid tissues themselves, which arrest it, and withdraw it from the sheath, it is diseased and strictured. This instrument which, except that it is straight instead of curved, does not differ much from Pare's urethrotome, is not less defective than Ducamp's bougies, is still more dangerous, and could only succeed in very large strictures.

We shall, by and by, discover what necessity in reality there is in practice for any of these precautions.

Amid so many contrivances, which one are we then to retain? The apparatus of M. Lallemand would evidently be the best, if it were indispensable that every stricture should be passed successively, when several exist. M. Segalas's, if it were less complicated, would possess equal advantages. But I must, after all, give the preference to that of Ducamp, altered by M. Pasquier, or as I myself use it, if one must be adopted to the exclusion of every other. But it is with cauterizing the urethra, as with every other operation;

to a skillful hand all instruments are good; to an unskillful one, there are none which will be found convenient.

Effects of the Caustic.—The nature of the effects produced is always the same, whatever may have been the procedure adopted. Whilst the nitrate is bare in the urethra, the patient feels pain and a stinging or burning sensation, which in some is obtuse, in others very acute; and which lasts for a longer or shorter time afterwards. This difference depends on several causes; some of the cerate, oil, or tallow, may remain round the caustic, and by its viscidity prevent it from acting; or the hardened tissues of the strictured circle may have lost nearly all their sensibility: on the contrary the nitrate may touch some sound part; it may spread behind or before the stricture; or the canal may be at the time the seat of a morbid sensibility and irritation, more or less developed. When there is no false passage, nor any discharge, the pain speedily subsides usually, and the blood does not always make its appearance. However a bath, either immediately or in the course of the day, is always useful to guard against accidents. When the stricture extends very far, or the cauterizing has been severe, it may happen that swelling and congestion may cause retention of urine; which is induced also in other circumstances by flakes of matter, or eschars, which are entangled in the centre of the obstacle. They are speedily got rid of by a fine bougie, a warm bath, and tepid injections. If we are threatened with inflammation, we must apply leeches to the perineum. On the morrow, or the second, or third day, flattened, grey, blackish, or whitish flakes begin to issue from the urethra with the urine, the exit of which they again render very painful. However this expulsion is not always present, but sometimes wholly wanting, notwithstanding that the caustic may have had a very powerful effect. As soon as irritability has subsided and the sensibility and tenderness of the organ permits, say in three, four, five, or six days, we recommence its application. Some persons, and I think them right in doing so, pass in a bougie for a few minutes, from time to time, during this interval. Others again resort to dilators only after the destruction of the stricture, which in that case demands from four or six to thirty or forty introductions of the caustic; and a treatment consequently of from two weeks to three or four months.

The Theory.—The last question which remains for solution, is that of the advantages derived from cauterization. Its advocates, with Hunter at their head, maintain that mere dilation is but a palliative means almost invariably followed by a return of the disease. That to obtain a cure which shall secure against a relapse, we must not merely mechanically remove and dilate the stricture, but that we must destroy and corrode it, as is done by caustic; after which bougies come in to smooth the surface and complete the cure. To this the opposers of the treatment reply, that the loss of substance which the caustic causes must leave a hard, elastic, and generally a rugous or uneven cicatrix, which will almost certainly bring back the stricture; that on this ground cauterization is even more subject to relapses than dilation; and that being incomparably more dangerous there appears no reason for giving it the preference. That to enable it to act at all the caustic holder requires a canal a line in width, which is a diameter that will always allow of the use of a bougie, and that this latter instrument will often pass where the caustic cup cannot enter. Arguing from the first of these objections they ask where is

the advantage of caustic since bougies are applicable wherever it is applicable, and that they moreover must precede and follow it in almost every case? These arguments never were and never could have been triumphantly replied to by those to whom they were addressed. To destroy force, we must take another view of the mode of action of caustic.

Nitrate of silver alters the vitality of the parts which it touches much more than it consumes them. In the urethra its action is to extinguish a chronic inflammation which produced a stricture, and by which it is almost always maintained and established, just as it extinguishes many cutaneous phlegmasiæ, tetter, erysipelas, the pimples of small pox, &c.;as it checks the progress of certain anginæ, aphthæ, ophthalmiæ, &c. By this agency it is, and not by causing ulceration, that it dries up old discharges, the seat of which is sometimes before, sometimes beyond the bulb of the urethra; that it has been so successful in the hands of M. Lallemand, among others, in many affections quite independent of stricture. But according to this hypothesis it ought to be our aim, instead of wishing to cauterize, ulcerate, and destroy, to effect mere touching of the parts. We should consider the nitrate of silver merely as a topical application, intended to *sufflaminate* the morbific cause; to bring about resolution of the lardaceous congestion and the absorption of the fluids effused or accumulated in the meshes of the mucous membrane and subjacent tissues; not to regard it as a true caustic. Therefore potassa, which M. Whately advises us to substitute for lunar caustic, is clearly a pernicious agent, which ought never to be employed in practice. Upon this principle we should explain the good effects derived from the medicated bougies of the ancients, and also how it is possible for every species of cautery used, to have succeeded. With this idea the use of nitrate of silver becomes extremely simple. Impression bougies become useless, because all that is required is to put it into the stricture with some instrument or other, without troubling oneself whether it is shorter or longer, above or below, provided that in dissolving it spreads at once over the whole circumference of the canal. Conductors perforated outside of the centre of the platinum socket which caps their extremity, in order to separate the caustic-holder from the sound wall of the urethra, and on the contrary to apply it more accurately upon that which is diseased, become equally destitute of importance. Bougies and caustic then hold the first rank; the first, to dilate and enlarge; the second, to cure the structure and to give to the tissues the original qualities of their normal state. Unless I am greatly deceived the treatment of the great majority of organic strictures of the urethra, may be reduced to the following rules: first to dilate them; to cauterize them for the first time only after four or five applications of the bougie; to recontinue the dilation; to apply the caustic a second, a third, and a fourth time, at varying intervals; and after having restored the canal to its utmost diameter, to return to it once or twice more to extinguish the last traces of inflammation and morbid irritation which may have remained behind.

§ 7. *Abnormal Dilation of the Urethra.*

In the case of a patient affected with incontinence of urine, whose urethra was considerably dilated, it occurred to M. Habort to excise partly the

walls inferior after which he re-united the wound by means of suture, and thus succeeded in restoring the vesico urethral functions.

SECTION IV.

Puncturing the Bladder

It is now so rarely necessary to interrupt the continuity of the bladder to give issue to urine, that M. Roux and several other surgeons of great distinction and experience have never encountered this operation. Since the diseases of the prostate and urethra have become better known, retention of urine is of very rare occurrence, and when it does happen the accuracy of anatomical knowledge possessed by most surgeons of the present day, enables them almost always to overcome it through the medium of bougies or simple catheterism. It may so happen, however, that every other means may fail, and we may be reduced to select between forced catheterism and puncturing; between two operations of equal danger, but the first of which it is not within every body's power to perform. The second may be practised in three ways; through the perineum, through the rectum, and through the hypogastrium.

Art. 1.—*Perineal Puncture of the Bladder.*

Opening the bladder through the perineum, as a means of remedying ischuria, must, to the ancient lithotomists who admitted no other way of extracting calculi, have appeared a very simple operation. Consequently it was the first proposed and for a long time the only one followed. Latta, to whom Sœmmering gives the credit of it, is no more the inventor of perineal puncture than Garengeot, who claimed fifty years previously. It is expressly advised by Riolan and Thevenin, and Tollet had performed it in 1681. Dionis, besides, describes it very lengthily, and proves that it can be performed in two ways.

An incision upon the raphe an inch long, as if for the apparatus major, permitted a long bistoury to be plunged into the front of the anus, quite into the bladder; a catheter to be slipped into it on withdrawing the knife, and a canula to be left in the wound, through which to evacuate the urine. But Dionis thought that it would be better to extend the incision a little outwardly as in Brother Jacque's method of performing lithotomy, so as to save the prostate. Juncker, Lapeyronie, and Heister, all about the same time conceived the idea of substituting a long trocar for the bistoury, which they supposed had very much simplified the operation. Thus conducted, it is reduced to the first period of Foubert's lateral cutting for stone, and is done in the same manner; that is to say, they buried the instrument in the middle of the space which separates the ischium from the raphe, directing a little forwards and within, so as to fall almost perpendicularly upon the neck of the bladder. A dread of straying, in passing through so many tissues, gave rise to the idea of cutting the perineum with a bistoury, and of using the trocar only after the distended bladder had been felt fluctuating with the finger. Sabatier has endeavored to cause this modification to be associated with perineal paracentesis, as Garengeot had indicated it for lateral cut-

ting, the result of which would be to blend the procedures of Dionis and Juncker. But this advice has been generally overlooked. Whilst authors in France have continued to recommend pure and simple puncturing, surgeons in England have ever adopted incision; and it seems to have been practised there in divers manners. Sir A. Cooper, following the steps of Dionis, cuts a little upon the left of the raphe, depresses the bulb with his left fore-finger, and then the prostate to the right, whilst with the other hand and a sharp scalpel, he divides the tissues and enters the bladder. Mr. Charles Bell, when he thinks it practicable to find the urethra behind the stricture, opens the canal, as in Cheselden's operation, and says that we arrive at the urinary bladder with less danger in this way. Mr. Brander advises us to come down to it layer by layer; but Jones and Dorsey do not see the necessity for so much caution. Indeed, I do not think that either of these shades of difference has much advantage over the others. If puncturing with a trocar be more speedy, it is less sure. The instrument, though safer perhaps for the vessels, the ureters and vesiculæ seminales, which it would rather separate than divide, escapes more readily between the different organic layers, and more easily misses the bladder. With a long and narrow bistoury we must next pass a catheter and afterwards a canula into the collection of urine. Though less probable, a false passage is still possible, and a wound of the organs which we have to avoid is much to be dreaded. Incision, properly so called, is most rational, most prudent, and at the same time most difficult. It is rendered more delicate and uncertain than in lithotomy, because of the want of a director, which cannot be passed through the natural passages; and this, whether it is attempted to save the prostate as in the lateral method, or whether we penetrate through the urethra. Still, as in such cases the bladder is always greatly distended, and its excretory duct much enlarged behind the stricture, if I am ever obliged to open an artificial passage for urine, I will confine myself to searching for the urethra, and making a slit in it between the stricture and the anus, though I should include the top of the prostate in my incision. The opening thus made would have the double advantage of giving entrance to the catheter and canula, which we might wish to introduce into the bladder, and of giving us an opportunity to attend directly to the diseased canal, from behind forwards. The slit of which I speak is neither more nor less dangerous than that in ordinary lithotomy, and is certainly much less so than many other species of punctures; and, if I am not deceived, is of such a nature as advantageously to supersede them in all cases in which a morbid or abnormal state of the perineum does not interfere to prevent our reaching the urinary passages in this region.

Art. 2.—Puncture through the Rectum.

The projecting cyst which the bladder forms low down upon the rectum when distended by urine, sufficiently justifies the idea of recto vesical puncture. It is indeed surprising that it should not have sooner given rise to it; for by carying the finger into the anus it must have been very often noticed. Fleurant, who imagined himself the inventor, and Pouteau, his successor, as a means of preserving the trocar canula in the part, so that they might not be obliged to perform the operation again if the natural

passage was long in regaining its functions, had the spoon of the canula of their trocar bent at a right angle with the concave side of its stem. By this means it becomes, as it were, reversed upon the perineal conduit in front of the anus, where it is easily fastened in such a way as not to interfere with the patient's walking or sitting, nor with the alvine discharges. Most of those surgeons who advise the leaving of a catheter in the wound, have adopted the instrument invented by the Lyonnese surgeon. Those who think with Hamilton that it is better to withdraw it at once, even at the risk of having to renew the puncture, require nothing but a trocar of the usual curve. Beyond this, it is a matter of but little consequence whether its point be flattened and of a lancet shape, or triangular, like that which Mr. Howship has endeavored to bring into use among his countrymen. Perhaps a straight bistoury, narrow, and guarded by a strip of linen around its blade, would answer the same end with less risk of producing fistula, and would penetrate better; but it is not as easily managed, nor so convenient for introducing a canula afterwards. The patient is made to assume the same attitude as for lithotomy. He might, in strictness, lie with his abdomen on the edge of a bed, with the legs pendant, unless such a posture added too much to his sufferings. If so, the surgeon would need no assistants, and would be more at ease for piercing perpendicularly the bas-fond of the bladder. In either case the fore and middle fingers of the left hand, besmeared with cerate or some fatty matter, are introduced into the rectum to reconnoitre the vesical projection and the prostate gland; stretch the parts by diverging from each other a little, and then are held firmly at some distance from the gland, the palmar aspect being turned forwards, their fleshy parts or the nails butting on the distended cyst, to serve as gorget or director to the trocar. The latter is carried in with the right hand, its concavity forwards, to the intestinal surface of the trigonal space, between the peritoneal cul-de-sac and the base of the prostate; it is then passed suddenly in, as if it were intended to be carried towards the umbilicus, that is to say, forwards and upwards obliquely. When its point has overcome the resistance and has entered the bladder, a few drops of urine escape by its lateral groove, which gives the assurance that no error has been committed. The blade of the trocar is then withdrawn. The urine flows, and as soon as the bladder is emptied the operation is over, unless we adopt the plan of fixing a tube in the wound. In that case a very elastic and flexible catheter, wrapped round with lint that it may be kept motionless upon the perineum, with the assistance of a T bandage and some compresses, is preferable to the canula of the trocar, which however will serve to direct its introduction. It is nevertheless doubtful, whether such a tube be necessary at all. In Hamilton's patient the wound re-opened of itself. Even if it did not, a second puncture would be attended probably with less inconvenience than would result from the long continued presence of a foreign body in the bladder and rectum. Finally, it would be useless at any rate, to leave the canula in longer than is necessary for the cohesion of tissues, that is to say, beyond four and twenty hours, for the inflammation which surrounds the little wound, although it puts no serious obstacle in the way of the issue of urine, still no longer allows of its infiltration into the meshes of the recto-vesical septum.

Art. 3.—*Hypogastric Puncturing the Bladder.*

The very opposite statements published in the last century by MM. Hoin and Noel, on the subject of this operation, prove that puncture above the pubis, which ought to have originated about the same time as hypogastric cutting for stone, had at that time but very few advocates. Tolet, Drouin, Turbier, Mery, Morand, and a small number of others, were, according to M. Belmas, the only ones who had performed it. But the authority of Brother Come, of Bonn, Paletta, and of Sœmmering especially who became publicly one of its most strenuous patrons, ultimately succeeded in bringing it into vogue in Europe, in spite of the efforts of Murray and Mursinna to establish that through the rectum. In France it is the only one which for a long time past has been performed. The case of intestinal puncture which is contained in the thesis of M. Duplat, and the two examples which have been contributed by M. Cabanell from the practice of M. Magnan, are rare exceptions which escape attention.

The straight trocar originally employed being liable to wound the organ behind it, and the beak of the canula, if left to remain in, being capable of ulcerating the posterior wall of the bladder, as it contracts upon itself after the evacuation of its contents, the curved trocar of F. Come has been generally adopted, whether puncture is performed without previous incision, or whether, after the method of Abernethy, the hypogastric paries is cut through with a bistoury before the trocar is employed. However, the operation is really so easy that the previous incision seems an unnecessary complication of it. The patient is made to lie horizontally upon the right edge of his bed. The surgeon feels for the upper edge of the pubis and the median line; applies the point of his trocar at about an inch above the symphysis; plunges it in at a single blow, from above downwards, and from before backwards to the bladder, which it reaches after a course which varies according to the embonpoint of the patient, and individual peculiarity of structure. The blade of the trocar being withdrawn urine flows out, and the canula, which is closed with a plug, is afterwards fastened around the body by means of strings which are attached to the lateral parts of its handle. But the canula is by far more dangerous above the pubis than in the rectum. When it is too long it causes ulceration of the organ; when too short its beak, separated from the bladder by the retraction of that organ, enters the surrounding cellular tissue and remains there. If it be not often changed it may become encrusted with calculous concretions and is not easy to remove. Having withdrawn it, it is not always easy to replace it. The gumelastic catheter carried into the reservoir of urine through the metallic canula, and which is left in instead of the other, being of smaller diameter does not completely fill the wound, and allows of urine flowing between the tissues and the foreign body. The flexible sheath, acting as a *chemise* to the instrument which is made to penetrate by M. Jules Cloquet, in such a way as that on withdrawing the trocar to let the urine flow out, and then the canula afterwards, it is alone left within the solution of continuity, is but an imperfect remedy for the inconvenience. It must always be shorter than the metallic tube, upon the outer surface of which its lower extremity always forms a projecting circle of more or less

irregularity, no matter what be done to thin and smooth it. Thence originates a series of elevations, or knobs, which it is more difficult to act on through the tissues. It would be erroneous again to suppose that a tube will long remain in close contact with an incision, the outline of which is precisely the same as its own circumference. Indeed this is no longer so after the lapse of a few hours, and the fluids pass readily between the canula and the wound. Of this, bougies and catheters in the urethra every day give proof, and I saw it verified at the hospital St. Louis in 1822, in the patient whose case gave rise to the above change in the instrument. All these reflections go to favor the reasoning of those who advise that nothing be left in the wound; and who prefer, in case of necessity, to repuncture the bladder after it has a second time become distended. I should entirely coincide in their opinion were it not that the more speedy approximation of the puncture in the abdominal parietes than that of the bladder, exposes to the risk of the filtration of a few drops of urine into the pelvic cellular tissue, and if the inflammatory state of the wound were not at the end of a few hours changed to one of a fistulous character.

A patient upon whom I performed it twice in three days, died on the sixth of peritonitis, which in him however, evidently existed before the puncture. A blackish abscess of limited extent was visible between the forepart of the bladder and the bottom of the hypogastrium.

Art. 4.—*Reciprocal advantages and inconveniences of the different species of Puncture.*

Each species of the vesical paracentesis has in its turn been lauded or proscribed to the exclusion of either of the others, and according to custom the strict truth has almost always been exceeded. Recto-vesical puncture, though not as terrible as Sœmmering asserts, is far from being as safe as it is pretended by Murray. Tumors in the neighborhood of the anus, the thickness of the septum at the entrance to the intestine, may render it of painful and doubtful, or of impossible execution. The instrument may escape into the cellular tissue of the pelvis, between the bladder and rectum, and open the peritoneum when this membrane descends considerably towards the prostate; or, when the puncture is made a little too high up, it may wound the vasa deferentia, the vesiculæ seminales, or even the ureters, if it be made laterally or too low. The organ being wounded very near the urethra, and consequently to the seat of disease, we run in this respect great risk of increasing the danger. Lastly, the wound may remain fistulous, allow of the entrance of stercoraceous moisture into the bladder, and give rise to symptoms which may prove fatal. It is true that the greater part of these difficulties will be most frequently overcome by a skillful operator, and that the unpleasant consequences of which I have just spoken are not all unavoidable. Fistula, however, the occurrence of which no skill or knowledge on the part of the operator can prevent, as is proved by the observations related by Bonn, Paletta, Angeli, and others, is of itself a very serious affection, and its cure is too difficult to permit us to incur the risk of inducing it whenever it is possible to avoid it. In exchange for so many objections, puncture through the intestine has the advantage of being generally easy, of bearing upon the bladder

at its most depending point, of passing through but a small extent of tissues, and those tissues of too dense a nature to create much dread of urinal infiltration or abscess, which have nevertheless been sometimes observed, particularly in one patient mentioned by M. Nauche, of rendering the use of a canula easy and of not confining the patient rigidly to his bed.

Super-pubic Puncture is unsuited to cases of retention caused by bruises, inflammation, or tumors of the hypogastric region. It must needs give rise more than any other to infiltration and to abscess. The bladder being opened upon its anterior surface, is emptied with difficulty and does not bear the presence of the canula as well. We are obliged sometimes to go to a great depth to find the organ, and the peritoneum is not entirely sheltered from danger. But there are no fistula to be feared, for even if the wound should assume this character there would be no cause for anxiety. The peritoneum, crowded over from the pubis by the sole effort of the distended bladder, it is easy to avoid, and to miss piercing the bladder with the trocar is next to impossible. The operation is still easier than that per rectum, and not more painful than tapping the abdomen; it acts upon a part of the organ which is not altered in structure, irritable or irritated.

Puncturing through the perineum is, beyond comparison, more uncertain than that through the hypogastrium; and endangers the urethra, or vesicula seminales, as does that through the rectum. It may be done too far forward, between the pubis and bladder; or too far backward, and enter the peritoneal cul-de-sac or the intestine; or it may enter the bladder by lacerating its parietes. The vessels of the perineum and the prostate gland, are neither of them secure from injury by the instrument. Abscess and infiltration are not impossible, and the presence of a catheter is no where more annoying.

The sole advantages of this puncture are, that it opens the bladder in a depending part, without exposing to fistulæ, as that through the rectum; it makes an easier exit for urine, and does away with much of the danger of urinal inflammation, incurred by that above the hypogastrium. Though few, these are important advantages, and but that they must be bought so dear, and if they were real, perineal puncture would bear away the preference over the other two. Now to me it seems that a mere slit in the urethra is better than either of them, and enables us to avoid neighboring organs with every certainty. As it is no otherwise objectionable than that it is rather more delicate and rather less speedy, I think it preferable every time that the shape or texture of the perineum is not too much changed from a normal state, and where the person who is to perform it has some experience in surgical operations.

In other cases super-pubic puncture should receive the preference, and recto-vesical tapping be reserved for occasional exceptions, and for circumstances which prevent special obstacles to the passage of instruments through the natural passage.

As to penetrating from before backwards through the symphysis, which Mr. Brander advises, and states himself to have performed, it is a method which will meet doubtless with but few defenders; first, because after maturity it would be often next to impossible; and, secondly, because it would be no safer on the score of infiltration than hypogastric puncture. It would be rash also to practice puncturing the bladder without some urgent indication; as, for example, for a retention caused by a mere spasm of the urethra, of

which M. Racine mentions two cases; for the supposed spasmodic contraction to which Mr. Holbrook has recently directed professional attention; but to wait too long would also add to the danger. The bladder of a person who has not made water for twenty-four, thirty-six, or forty-eight hours, being distended to an excessive degree, may give way and even burst. Pain, fever, and a partial entrance of the urine into the circulation, soon throw the patient into so alarming a condition that puncture can no longer avail in saving his life, nor prevent a host of occurrences which a few days before might have been avoided. The observation just cited, is my own, and furnishes new proof.

SECTION V.

Urinary Fistulæ.

Recto-vesical fistulæ, which are no less dangerous and still more unyielding than those in the vesico vaginal septum, are healed in the same manner by similar procedures. The surgeon, however, always commences by restoring the urethra to its natural dimensions, when it is strictured; by depressing the prostate gland with the assistance of the *redressor*, an instrument contrived by MM. Tanchou, Pravaz, and Leroy, when its size is such as to impede the flow of urine; and by destroying all obstacles which the bladder may experience towards ridding itself by the natural passage. Desault cured recto-vesical fistula following cutting for stone, by incising all the parts situated between the wound in the perineum and that in the intestine, including the sphincter ani, so as to lay the whole into one incision. But if the first incision had long been healed, either this procedure would be applicable, or would require some modification. We might in such a case advantageously imitate the method of Sir Astley Cooper, who re-opened the prostatic portion of the urethra upon a catheter, through the perineum, and from before backwards, so that the urine having issue anteriorly might allow of the closure of the posterior orifice; and entirely succeeded by it in one case. An incision with a bistoury, drawn out from the fistula to the perineum, upon the groove of a staff as in the recto-prostatic operation for stone, would be easier and surer than Desault's oblique operation, if Sir A. Cooper's did not seem likely to suffice; but it exposes the veru-montanum and ejaculatory canals to injury.

Fistulæ which are of the kidneys, the ureters, the top or face of the bladder, which do not open exteriorly, or are within the intestines beyond the reach of instruments, can derive no succor from surgery, unless they depend upon some impediment, such as a calculus or a stricture, for example, which might either be removed or destroyed. Fistulæ at the umbilicus, owing to a continuance of the urachus, are of the same kind.

Spontaneous Cure.—In the urethra it is not always so. In the pars spongiosa they rarely fail to disappear spontaneously, after care has been taken to restore the natural dimensions of the canal. Towards the fossa navicularis at which M. Barthelemy has seen them open, like the top of a watering pot, on the gland, they will be closed almost with certainty by confining the patient to urinating for several days through a catheter, as was done by that

surgeon; and moreover, by taking care every time that the bladder is being emptied, to place the finger firmly behind the glans so as to keep the canal closely applied against the instrument.

Injections. Cauterization.—Fistulæ of the bulbous, membranous, and prostatic portions, usually most frequent and most obstinate, are the only ones which merit special attention. The first and only course to be adopted, whether there be one or several external apertures; whether they be sinuous or straight; whether they go to terminate at a long distance from their starting point towards the scrotum, in the groin, in the nates, in the anus, on the inner part of the thigh, at the extremity of the labia majora in the female; whether they stop at the perineum; is to sound the urethra and destroy all its strictures. If they resist this preliminary treatment, recourse must be had to irritating injections with alcohol, vinegar, the dilute mineral acids, to caustic, the nitrate of silver, to troches of the deutoxide of lead, of nitrate of mercury, to compression, and, in a word, to the different medications used in cases of fistula generally, and which properly appertain to the science of chirurgical pathology. If they still remain incurable and sinuous, they must be cut into, and their fundus laid bare; after which derivative catheterism, a re-application of caustic and suture, can alone effect their cure. Some few, resisting every method, end in time by getting well of themselves. Of this I have just seen a fresh and remarkable example in the case of a distinguished physician who, having exhausted every means of treatment pointed out to him by MM. Boyer, Dubois, Dupuytren, Richerand, Marjolin, Roux, Cloquet, and myself, recovered in this way.

Derivative Catheterism succeeds only in those fistulæ in which there is either no loss of substance at all or very little, whether preceded by stricture of the urethra or not. Neither the permanent gumelastic catheter, the S shaped catheter which J. L. Petit employed, that with a fixed curve such as Mr. Hey recommended, the strongly-curved instrument advised by Dr. Physick when there exists engorgement of the prostate, nor the flexible one which may be directed at pleasure, which since Desault has been generally employed in France, are always without their inconveniences. If they remain open so that the urine may run off as fast as it is deposited from the ureters in the bladder, the point resting against the posterior paries of the organ irritates and ulcerates it, even perforating it sometimes. If they are kept closed the small quantity of urine which almost always passes them and the walls of the urethra, suffices, in most cases, to prevent the obliteration of the fistula. This fact was well established by M. Asselin in his thesis in the year 1803. It is better, therefore, to pass the catheter every time the patient desires to urinate, or better still, let him learn to pass it himself, giving the preference to a silver instrument. A patient whom, without success, I treated with catheters permitted to remain, in 1830, at La Pitie, recovered entirely in three days after I began to have them passed every four or six hours, and afterwards withdrawn. Caustic may be combined with catheterism; and indeed, where the cure is protracted for a week or two, becomes indispensable. If the disease continues after a lapse of six weeks or two months, we may, without incurring censure for our precipitation, resort to the last chances left.

Suture is performed upon this as upon every other part of the body. We

begin by making a slit of the fistula of an elongated form, more towards the integuments however than towards the wall of the urethra. Having stimulated the edges and removed their callous portions, and having brought them together over a flexible catheter, destined to remain permanent, they are maintained in the most perfect apposition possible, by means of a sufficient number of small points of the twisted suture; the points should not be more than three or four lines apart, if we do not wish to see the urine oozing through them, and should for the same reason be so tight as to effect immediate adhesion. We then apply over the perineal fissure, some lint and compresses, and support the whole by moderate pressure. If all does well, we take out the pins on the fourth or fifth day, beginning with those at the angles of the wound. The catheter is left in a day or two longer. This is in turn removed, and the patient is cured. M. Cloquet has recently been successful in a procedure of this kind. Unfortunately, as the fruitless attempts of Mr. Charles Bell too clearly demonstrate, one is not always so fortunate. It becomes frequently necessary to repeat the operation often; nor even then is it rare to see all the skill of the surgeon and the patience of the patient terminate in an increase of the size of the fistula.

Urethraplastic Method.—When the loss of substance is at all extensive, simple suture is seldom indeed sufficient. The modification invented by M. Dieffenbach, which is as applicable in other cases as in this, may be of essential service. Proceeding on the Celsian precepts for the hare-lip operation, this surgeon makes an incision longer or shorter on either side, an inch or half inch beyond the ulcer, which should extend as far as the aponeurosis. Then having performed suture in the usual way, the result is great relaxation of the old sore, the agglutination of which there is now nothing to impede. When this is affected, the lateral incisions heal like any other simple wound. In this way M. Dieffenbach has at the Charite of Berlin, cured fistulæ over which no other treatment could triumph, and I think his conduct well deserving of imitation. But it would be wrong in any one so much to exaggerate its value as to regard it as of never failing success. The very great distinction of tissues, such as we see consequent upon gangrene of the scrotum, perineum, certain operations, &c. will continue to require something more than this. The only chance of recovery then offered is from the recto plastic method. It was tried in London once by Sir A. Cooper and succeeded; by him again another time and it failed. Mr. Earle performed it twice upon the same individual, who ultimately got well. In France, I believe the only person who has attempted it is M. Delpech; yet in spite of his acknowledged skill as an operator, and although the operation was frequently repeated in the same individual at different times, the fistula continued open. Instead of taking a portion of integument from towards the scrotum, or from the sides of the penis, as has been done by English surgeons; or borrowing it from the groin or inner surface of the thigh, as the professor at Montpelier preferred to do, which he might turn over and fasten to the re-animated edges of the fistula by means of simple suture; it would be perhaps better to follow the advice of M. Roux, for the cheiloplastic of M. Dieffenbach, for the rhinoplastic methods; to act, in a word, by dissection and re-approximation, rather than by turning over of points. If so, the fistula being arranged as if it were intended to perform

common suture, its two edges are to be dissected alternately from within outwardly, to an inch more or less towards the root of the thighs in such a way as to form flaps, which are to be made as thick as possible. The edges are then to be stimulated either by the use of a bistoury, or of good scissors; and are then coaptated either with simple or twisted suture. Graduated compression exercised laterally upon them, will keep them closely applied against the subjacent tissues, and will guard against the infiltration of urine. Experience, however, has not yet decided in favor of this method of operation, and consequently I shall not go more largely into its detail. I must say the same of the procedure of which I spoke when upon the bronchoplastic method, and afterwards of hernia; because, having not yet practised it in a case of urinary fistula, I can only look upon it as one very likely to succeed.

Congenital Urethral Fistulæ, near to the glans, admit of no other operation than the creation of a new canal in the thickness of the penis, which was once performed by M. Rublach, and with success.

CHAPTER VI.

THE ORGAN OF DEFÆCATION.

SECTION I.

Defects of Structure.

Art. 1.—*Imperforation.*

It is common in newly born children to see the rectum open into the bladder or vagina, into the perineal portion of the urethra, or towards the posterior part of the vulva, instead of ending at its proper aperture, the anus in front of the coccyx. Still more frequently it ends in a cul-de-sac, above its natural termination, more or less high, up in the pelvis. The first cases belong to the category of unnatural anus, and are cœteris paribus, less inevitably fatal than the second. The meconium infused into the bladder is softened there and diluted, and may pass from it for some days. A child whom I saw that passed it per urethram, lived nearly a week. The orifice of the receptacle, and the size of its excretory duct, are so small however that when the fecal matter acquires much consistency, life cannot be supported, because the urinary organs cannot long endure without danger the immediate contact of stercoraceous substances. Recto-vaginal anus, recto-vulvar anus, and indeed all external anuses resulting from defects of conformation, are disgusting infirmities, but do not necessarily cause death. But, on the contrary, where the intestine is devoid of opening entirely, or opens into an organ which has no outlet externally, the child sinks rapidly. In either case art has but two resources to oppose; 1st, to re-establish the anus in its natural situation; 2d, to create one artificially in some part of the abdominal cavity.

§ 1. *Re-establishment of the Natural Anus.*

To re-establish an anus which is closed only by the integuments, or by a layer of tissue not more than a few lines thick, is not an operation of any difficulty. A projection or a bluish spot usually point out its situation, and the obscure fluctuation which is at times perceived by the fore-finger, allows of our proceeding fearlessly. Instead of surrounding it by a circular incision, as Levret advises, the surgeon passes the point of a straight bistoury or a trocar, in at the middle of the spot, in the direction of the rectum, until he comes to the meconium; then enlarges the puncture in its antero-posterior direction, and transversely cuts away the four flaps thus made; places in the opening a pledget or tent of lint, or a suppository of some sort, to prevent it from closing; and continues dressing it with dilating substances until it has entirely healed. Many successful results have been obtained in this way, and in like cases no one should hesitate to adopt it. The same operation would be required if, the anus existing, the rectum were closed by a septum some way up. Only it might then be proper to surround the bistoury with a strip of linen, unless we preferred J. L. Petit's trocar or M. Martin's pharyngotome. In these cases it is not practicable to excise the angles of the conical incision.

It would be easy to re-establish an anus opening at the fourchette, a case of which in a little girl M. Brachet has just published. All the tissues which have kept up the deviation from the natural course may be divided by a straight bistoury passed into the intestine through the fistula upon a director, and withdrawn from before backwards, or from the perineum towards the coccyx, and from above downwards. A canula fastened in the rectum and carried up as far as into the posterior angle of the wound, will allow the solution of continuity to heal in front, and enable the fecal matters to resume their normal direction. Vicq d'Azyr has recommended the same operation for vaginal anus; and the advice of Mr. Martin is to divide, first, the whole septum from above downwards, and from before backwards, as previously mentioned; then to place the canula in such a way as that superiorly it shall go a little beyond the fistula; and afterwards to re-unite the wound by means of stitches on its anterior surface. This last step in the operation, by far the most difficult, does not seem to me to be necessary. If the tube which is to carry off the fecal matters from the fistulous orifice, be suitably placed, the divided tissues will unite very well without the intervention of stitches.

There exists, moreover, another mode of avoiding this, and arriving at the same result with a less inconvenience, viz. to ascertain, by means of a blunt instrument curved like a crotchet, introduced into the fistula from above downwards, how low the intestinal sac descends, and to enter the rectum by puncturing from the skin towards the pelvis without any division of the recto-vaginal septum.

In children of the male sex we have not the same resource. The exit of meconium only at the moment of the flow of urine, though a proof of the existence of an entero-vesical anus, neither points out the precise seat or direction of the end of the rectum. If it escape incessantly, or at intervals,

without any admixture of urine, it may be presumed that the aperture is in the urethra; and although it may not always be discoverable whether it be a short way from the glans, as seen by M. Cruveilhier, or more deep towards the perineum as is oftenest the case, we have yet some right to expect success from methodically puncturing where the rectum ought to be. In the first case, and in those likewise in which externally nothing exists to lead to any suspicion of the state of parts within, the operation being undertaken in a measure at random, naturally offers a less chance of success. It would be a remedy at least as disgusting, if not as dangerous, as the disease itself, to cut into the perineum and neck of the bladder as in operating for stone, for the purpose of making a large aperture common both to feces and urine, in cases where the intestine had its outlet with that of the bladder.

The child upon which M. Cavenne of Laon, thought proper to perform it, died the same evening; and M. Martin of Lyons, who proposed it, never probably reflected that as the operation left the recto-vesical anus in its state of original contraction, it would not even be advantageous in prolonging the life of the new born infant.

The only method which has thus far been attended with any success, is *to go in search of the intestine* through the tissues by which it is separated from the skin. The child is to be held upon the knees of an assistant, or on a covered table, with its limbs separated and bent. The surgeon facing it examines the groove between the nates, or the interperineal fissure, if it exists; and if he discerns no trace of intestine or anus, endeavors to detect the point of the coccyx; places the centre of this cut about ten lines forward of that bone; first, divides the skin to an extent of from ten to twelve lines, and then successively the tissues beneath to a depth of one or two inches, that is, until he comes to the intestinal cul-de-sac, if any, or until he abandons all hope of finding one. The left fore-finger, which acts all the time as a guide to the point of the bistoury, passed down to the bottom of the wound, occasionally for some moments together will not fail to percieve the projection and fluctuation in the distended organ, and will serve to show the direction in which the point of the bistoury or trocar should be passed. This dissection will at first be made in the axis of the body, *i. e.* perpendicularly nearly, but it must afterwards incline towards the sacrum by degrees, to follow the natural course of the rectum, and to avoid wounding the bladder. In this respect a trocar is a less certain and safe instrument than a bistoury, for as it enters blindly, it would inevitably pierce the bladder, which fills nearly the whole pelvis, if there should prove to be no intestine. Besides which it gets too easily lost among the soft parts to be here deserving of much confidence. Puncture of any kind could supersede dissection without disadvantage, only when the cul-de-sac, filled with fecal matter, is perceptible either by the finger or to the eye; either on the skin or at the bottom of the wound. Having once entered the gut, it is skillfully to be enlarged in various directions, and in that particularly in which there seems to be most space. A tent of lint or linen is then passed in, or else a canula, and the operation is at an end. We have then only to keep open the new anus to give it size enough, and prevent its contraction or obliteration. This operation, for the performance of which opportunities often occur, is rarely followed by complete success. Roonhuysen, F. Hildanus, de la Motte, &c. who have had most reason for

praising it, admit that their patients ultimately perished at the end of a few months, or one or two years; and B. Bell, in whose hands it had some success, states positively that it is almost impossible to prevent the new orifice from closing. The cure obtained by Wagler, which continued unimpeded in a patient whose perineum he uselessly incised, and on the following day thinking he could feel the rectum at the bottom of the wound, passed a lancet into it, was owing doubtless to the intestine being near the sphincter, and to his not being obliged to go deep. I must say the same also of the case of a little girl, upon whom a surgeon operated, who is mentioned by M. C. L. Lepine, who died three years afterwards of a totally different disease; and of a more fortunate one still, reported by Mr. Miller.

The reason for the want of success, is but too easy to give. The absent portion of intestine can never, otherwise than very imperfectly, be restored. It is placing of a fistula in lieu of a natural tube. The species of mucous surface, which is at length formed, represents the tunics of the natural organ but very imperfectly. Though the organism may fail to close a stercoral fistula entirely, it nevertheless is constantly striving to diminish their size; so that they soon become mere passages for the escape of fluid substances.

The absence of sphincter is another hopeless cause of its failure, especially. When this is the case it becomes extremely improbable that the opening artificially made can be kept up with any ease. Still it is not to be supposed, with Dumas and some others, that in every case an artificial anus in the side of the abdomen is preferable. This is no other than a fistula without a sphincter, and whenever it can be made in the perineum, will be attended with fewer disagreable occurrences to the patient.

§ 2. *The Establishment of an Artificial Anus.*

The *first person* who, in a case of imperforate rectum, conceived the idea of making an artificial anus in the iliac region, in the sigmoid flexure of the colon, was Littre, in 1720. It is scarcely conceivable how Dumas, who repeated the proposal in 1797, should have given himself out as its inventor. M. Dubois had performed it before him, in 1783, upon a child who died on the tenth day. On the 18th October, 1793, M. Duret of Brest, performed it with complete success; and Pilore in Rouen, was not less fortunate. But the child upon whom Desault operated in 1794, lived only four days afterwards. The abnormal super-pubic anus, noticed by Voisin of Versailles, comes in aid of the hopes raised by the results obtained by Duret and Pilore, as the child lived and discharged its feces by this passage. It is true that they have since then been in several instances disappointed. M. Ouvrard of Angers, lost his patient as quickly as Desault in 1820; and M. Roux was as unsuccessful last year in a similar case. Where, after all, is that operation which does not sometimes baffle the attempts of the surgeon?

The little patient lies upon its back, its thighs extended, and is held by one or two assistants. The surgeon, conveniently seated, makes an incision of about two inches long, a little above the Fallopian ligament, between the anterior superior spine of the ilium and the pubis; divides, layer by layer, skin, *fascia superficialis*, the aponeurosis of the obliquus externus muscle, the lower fibres of the small oblique, the *fascia transversalis*, and peritoneum, the

aperture in which he subsequently enlarges by employing a grooved director as a guide to the instrument. The distended intestine, of a livid or greenish hue, shows itself behind the wound, and may be known moreover by the appearance of its covering, and the disposition of its fibres. The fore-finger seeks for it and brings it outwardly by acting as a hook, or else by assisting the thumb to lay hold of it. A loop of thread is then passed through its mesentery by which it is prevented from returning. It is opened in the direction of the wound in the belly. Feces escape; it becomes empty. A tent or pledget is then placed in it, if there is any fear of its closing too soon. Adhesions are soon formed between the surface of the colon and the walls of the wound in the abdomen. The loop of thread is withdrawn from the mesentery on the third or fifth day, and the new anus, then definitely established, requires no other care than any new formed anus whatever.

2. *Procedure of Callisen.*—This consists in piercing the side to get at the left lumbar colon between the two portions of its mesenteric fold, without opening the peritoneum, but has never been performed upon the living subject. I am wrong. M. Roux once applied it to a little patient who died in two hours afterwards. It does not deserve to be rescued from the oblivion into which modern surgeons have thrown it. It would be incomparably more difficult, and not less dangerous than the preceding, as well as being much more inconvenient.

3. *Procedure of M. Martin.*—The project attributed by M. Paris to M. Dubois, and which served as the text of M. L. A. Martin in his thesis, of carrying in at the iliac opening of the intestine made according to the procedure of Littre, an exploring instrument from above downwards for the purpose of seeing whether it might not be possible to re-establish the natural anus by perforating the perineum, has also hitherto been attempted only on the dead body. It would be unjust, however, entirely to despise or reject it. If a mistake should by chance have been made, and the rectum should have descended low enough to be continued as far as the skin without too much difficulty, we should be still better enabled to perform the operation. A flexible catheter, or one conveniently curved, would first point out the state of things. I would not, however, advise either the large flexible canula, nor the enormous trocar recommended by M. Martin, to transfix the parts from within towards the exterior. It would, in my opinion, be better to penetrate through the perineum in search of the beak of the catheter; or if it were found practicable to pass into the pelvis the sonde-a-dard, the dart and stylet of which pushed towards the surface in the direction of the anus, might serve as the guide to the bistoury during the rest of the operation. But as it might be somewhat imprudent thus to multiply incisions at one time, and as there would always be time enough afterwards to employ this resource, it might be as well to wait until the health of the child is restored to its natural state, and to choose some apparently more convenient time for its performance.

If experience had sufficiently demonstrated the innocence of Littre's method, its advantages would not be confined altogether to new-born children. It might be likewise applied to remedy the many cases of intestinal obliteration which show themselves after birth. As every stricture of this kind is of a fatal nature, we can see no reason why an artificial anus should not be established. The difficulty would evidently be to acquire the certainty that

there exists any obliteration at all, and next, to be sure that it is situated in the rectum or lower portion of the sigmoid flexure of the colon, or in the large intestine at least, so that by making the anus in the right fossa iliaca it might be above the disease. This, however, may often be arrived at. Braillet entertained no doubt of it, in the patient whose case he has communicated, nor was M. Martin Solon deceived in the fact quoted by M. Paris. The circumstance was equally clear during the illness of Talma. I might say the same of the case of a woman whom I examined after death at the Clinique Externe in 1825.

The procedure, moreover, would require no other alteration save that, instead of being always carried to the left, it might become indispensably necessary to direct the action of the instrument upon the right fossa iliaca, if the transverse or ascending colon were attacked by the stricture. After all, however, the operation exists not in theory only. Surgeons have been bold enough to perform it upon the living human subject, and M. Martland, who first attempted it 1814, was fortunate enough to cure his patient.

Art. 2.—Strictures.

Strictures, whether congenital or artificial, which are not cancerous, but merely organic contractions of the organ of defecation, may be overcome by operations similar to those performed upon the urethra. Their great frequency at the upper part of the anus, is explicable by the species of fold or valvular border seen within the rectum a little above the sphincter, which represents a species of pylorus, and upon which, before Mr. Houston of Dublin, no one had ever laid any stress. Higher up than this, they are almost always consequent on ulceration, and upon degeneration of a kind difficult to be restrained, and therefore they yield less frequently than the former to surgical remedies.

§ 1. *Dilation.*

The use of dilation in stricture of the lower portion of the rectum, so highly lauded by Desault, and since him by a majority of surgeons, does indeed deserve a good deal of the praise which it has received.

All those indurations, results of chronic inflammation, which involve the mucous membrane only or the subjacent cellular tissue, and even some lardaceous degenerations, admit of the application of this means of cure. Dilation here acts by the same mechanism as does compression in external congestion. The excentric pressure which it causes, forces the effused solidified substances in the natural organic meshes of the tissues to re-enter the general circulation, thus bringing back the intestine by degrees to its original thickness and increasing its size; and by extinguishing its principle, often removing the morbific process. This result is not, however, attained with equal facility on all parts of the rectum, nor in all species of stricture. Dilation, in all cases where the disease consists of irregular tumors extending more outwardly than within the canal, in which it occupies a point too badly surrounded to allow of accurate pressure, or if the apparatus is ill applied, generally does more harm than good. It is performed with rolls or tents of

lint, spread with cerate or some medicated pomatum, renewed every day, and gradually increased in size.

These tents, for which, in fact, any other supple or flexible cylindrical body may be substituted, do very well for affections of the rectum high up, and for those of the anus, properly speaking. But for such as are between the sphincter and concavity of the sacrum, another course must be adopted. A little linen bag introduced empty, like a purse with its bottom upwards, filled with lint, so as to effect pressure from above downwards, as well as all around, when an attempt is made to withdraw it, seems then to be better indicated, and should have a preference over bladders distended with air, water, or any other fluid. These two methods possess, however, the common inconvenience of arresting the progress of fecal matters, and thereby in many patients give rise to much uneasiness. It would, therefore, be well to follow the advice of M. Bermond of Bordeaux, and employ his apparatus instead of the tents or purse I have mentioned. This apparatus consists of two concentric canulæ, about six inches long, the inner one smooth, and ending superiorly in a cul-de-sac, the outer one open at both ends, and having circular grooves at intervals on its exterior surface to admit of the adaptation of *chemise*. They are sheathed in each other, and so carried up into the organ. Lint is then passed up by means of a long forceps between them and their linen envelope, so as to press this out into an annular projection on a level with the top of the instrument, and so as to bear more in this and less in the other direction as may be requisite. The whole is fastened outside very firmly. When it becomes necessary for the patient to discharge the contents of the bowels, the inner tube is withdrawn without interfering with the other, which may have a diameter of six lines. The lamp-bottom formed by the chemise above, necessarily causes the fecal matters to accumulate there, which, if required, may be dilated and made fluid by glysters. The central canula is afterwards replaced, which catches, by a spur on its side, in a groove which exists in the enclosing canula near its free end.

When the disease is not within reach of the finger, neither the tents, the linen bag, bladders, or the double canula of M. Bermond, are applicable any longer. For these particular cases, M. Castallat has contrived a little apparatus which may be pushed up a distance of more than a foot, and which in other cases also would not deserve to be slighted. I have already spoken of it when upon the subject of strictures of the urethra. It also consists of a chemise, shaped like a *condom*, preceded by a long, probe-pointed, or buttoned stylet; it is carried up by a gumelastic catheter, and made into a tent by means of cotton passed up within it by a forked stylet. The author assures me that he has used it with great advantage upon a patient whom several distinguished surgeons had pronounced to be incurable.* It is to be regretted that it is too complicated to become general, for the idea is an ingenious one; and it is very desirable to have it so much simplified, that every one should be able to use it.

* The patient has since called at La Pitie, where I had an opportunity of examining him. The stricture in the intestine has relapsed into its original state of contraction.

§ 2. *Incision.*

Before dilation was proposed, and even since it has been in general use, incision into strictures of the rectum was practised, either as a principal remedy or as an accessory means. Wiseman recurred to it three times on the same individual, Ford had the good fortune to see his get well without a relapse, and Mr. Copland states himself to have been as successful. The operation, unless it be necessary to go to a considerable depth, offers but few difficulties.

The probe-pointed bistoury, carried flatwise on the forefinger, and introduced within the constricted circle, is the only instrument we want. Its edge turned towards the parietes of the intestine, divides the stricture in one or several places, taking care not to pass the thickness of the viscus. A large tent is then introduced to just above the wound, and the case is treated as a simple dilation. The kiotome, or the instrument invented by Desault for cutting frena, here finds an application, if any particular instrument is thought necessary; or the pharyngotome may be used, as was once successfully done by M. Duplat. The incision becomes too dangerous when the finger can no longer accompany the knife, for us ever to think of venturing upon it. Annular strictures of a semilunar shape, or like a frenum, alone authorize its being practised; and it can only be seriously advised as preparatory to, and as a means of assisting, the operation of dilating instruments.

§ 3. *Cauterization.*

It is rather surprising that strictures of the rectum should not have been treated with caustic as well as those of the urethra. Every thing leads to the belief that it would have a like effect; that the nitras argenti employed as a topical, or catheteric application, would very much assist the success of dilation, by destroying the principle of chronic phlogosis upon the mucous membrane of the intestine, as it so often has done in the excretory canal of the urine. But I do not know that it has yet been used in such a case, and having no data but theory and analogy, I cannot devote to it any long detail. I find, however, a very conclusive instance of it in a thesis sustained in 1823, at Strasbourg, by M. Duplat.

SECTION II.

Acquired Lesions

Art. 1.—*Foreign bodies in the Anus.*

So various are the shades of difference in the shape, size, and nature of the foreign bodies which become stopped in, or are introduced into the lower part of the rectum, that no settled operation, nor fixed rule of procedure can be laid down for extracting them, which has, so to speak, to be changed for each particular case. The fingers and thumb, dressing or lithotomy forceps or

the whole hand when it can be introduced, are the means which first suggest themselves. The hand of an intelligent child, as was used in the case of a patient mentioned by Nollet, who had pushed a phial of eau de cologne above the sphincter, or that of a midwife should be used, if the hand of the surgeon is too large. If the substance is wood, or vegetable, or animal matter, solid and not flexible, a gimblet or a screw-ring (*tire-fond*), will be found of important assistance, as the facts related by Saucerotte and M. Bruchman prove. A pig's tale introduced by its base, the hairs of which previously cut, butt and rise against the intestine at every attempt to withdraw it by traction, should be managed in the way that Marchettis treated the prostitute who was made the victim of their malice by the students at Gottingen. By means of a string tied to its lower end, he succeeded in slipping over the foreign body a reed canula from below upwards, which separating it from the sides of the intestine, and acting as a sheath for it, enabled him to withdraw it directly without any difficulty.

A patient once passed a sweetmeat pot into his rectum, its small end going first. Violent irritation succeeded to this extraordinary proceeding, and the intestine very soon turned over from above downwards into the vase, like a red tumor filling up its cavity. Desault could only succeed in removing it by applying two very strong forceps to opposite points in one of its diameters, one after the other. Instead of two, four might be employed if it were necessary to pull still more strongly, or to separate the circumference of the anus in more places at once. A large ring, a ferule, or a metallic goblet, would not probably resist such treatment. If it were of glass, of crystal or porcelain, or any brittle substance, it might be broken with forceps, if it could not be brought away in one piece. A narrow saw guarded by a gorget, and the forefinger ought to be tried in case a piece of wood, horn, or ivory, should have become fastened crosswise between the two walls of the gut; whilst a body of steel, iron, silver, &c., will sometimes call for the use of cutting nippers, or of true shears. Biliary calculi, and that species of ægagropili which is met with in the intestines of man, as well as in animal, require to be crushed by strong forceps, or broken into fragments by long and powerful scissors, if they cannot be overpowered by the hand, hooks, the screw or gimblet.

Hardened feces, concrete balls, and stercoral calculi, which in many persons become sources of symptoms, the nature of which is never suspected, often require the use of blunt hooks or the finger, of wooden spoons of greater or less length, or the delicate hand of a child or woman.

Divisions and incisions either of the anus, or intestine, on elevated portions of its parietes, are never to be had recourse to, until the inutility or insufficiency of such measures has been fully established. Then, as in the preceding cases, we are to employ the speculum brise, or else the simple speculum, made incomplete by a slit of two or three lines in width, which divides it in its whole length on its free side, as advised by M. Barthelemey, either as a means of dilating the anus, or to assist the action of other instruments. The incisions themselves are sometimes made with a straight bistoury wrapped round with a strip of linen, sometimes with a probe-pointed, straight or crooked bistoury guided on the finger, and thirdly, with good scissors.

Upon the whole, foreign bodies in the rectum, are treated in no way differently from those lodged in the vagina. To the means above specified, we may

add, I think, as appropriate in either situation, lithotritic instruments; and it may be borne in mind that the litholabe, the perforator, and the stone-breaker, are much less dangerous to manage in the rectum, or vagina, than in the bladder and urethra.

Art. 2d.—Polypi.

Polypi of the rectum, though not very uncommon, are still not seen very frequently. If they exist at a distance of six or eight inches up, it is next to an impossibility either to reach or detect them. If seated lower they are easier to get at, and require to be treated much as those which are situated in the sexual organs of the female. It is too easy to excise them to render it necessary to advise tearing them away, or the use of caustic, while ligature is in scarcely any case applicable to them. When above the sphincter, they are to be hooked with crotchet forceps, or a double hook, held by an assistant. If the anus offers any resistance, a *speculum brise* must be introduced into it. The surgeon then, with a pair of long scissors, rather curved on their flat surface, protected by the left forefinger cuts off their peduncle. If still lower, the method of excising them, is the same as that of hæmorrhoids, which we shall presently describe; and in either case the measures hereafter to be mentioned for guarding against hœmorrhage are to be pursued.

Art. 3d.—Hæmorrhoidal Tumors.

Hæmorrhoidal tumors, cushions, or tubercles, which are sometimes concealed within the anus, and only visible when the patient strains on going to stool—sometimes salient externally—are, when they continue in spite of the methodical use of pressure, and the employment of antiphlogistic, detergent, astringent, and catheteric topical applications, sources of many dangers and inconveniences. Nitrate of silver would triumph over them in the beginning only, or when they were yet of small size. The red hot iron, so much extolled by the ancients, which M. A. Severin was so much displeased at not being allowed to apply to a patient of high rank, because of that persons *cowardly* physician's obstinacy, would answer doubtless oftener and better; but the means possessed by art, of a surer and less alarming nature, have long ago caused it to be forgotten. At the present day, in spite of the arguments urged by M. Mayor in its favor, *ligature*, even though easy, is generally abandoned. Tumors, such as the mere cushions, which have no peduncle, do not allow of it use; and the cases mentioned by J. L. Petit, show that under other circumstances it may give rise to very serious symptoms, such as violent pain, syncope, convulsions, inflammation of the intestine and peritoneum; and this, too, whether the morbid growth was allowed to fall off spontaneously, or whether, as Galen had advised, it was excised directly this side of the ligature.

The only operation, then, to which they should be subjected is *excision*. This of itself seldom offers any great difficulty. The only alarming thing about it is the bleeding which may follow; and that process is consequently the best which least exposes to the occurrence of this accident, and most safely opposes it.

The patient lying on the edge of a bed or covered table, one thigh (the under one) being stretched out, the other flexed, so that the anus may be perfectly free, is to be held by several assistants. The surgeon facing the affected part, is, according to M. Boyer, successively to take hold of every tumor, beginning at the lowermost ones, and proceeding to those which are highest, with good dissecting forceps or a hook, and to detach them one after another with a bistoury or a pair of strong scissors. If they do not project outwardly, an effort like that on going to stool will make them protrude; but it is important, as the pain of the removal of the first always occasions considerable retraction of the anus by which the others recede into the rectum, to fix them all with as many hooks or forceps, or by a thread before cutting any of them. It is wholly superfluous to follow the advice of some authors, and dissect them out like cysts, so as to remove as little as possible of the mucous membrane or skin. It is much easier, besides, to give such advice than to follow it. Loss of substance can here be no source of disquietude; the wound heals well, and after the cure the organ regains its original flexibility. All the dressing required is merely the introduction of a large strong tent, spread with cerate, carried in for a depth of some inches, supported outwardly by lint, compresses, and a T bandage.

If loss of blood is to be feared, the dressing is not quite so simple. M. Boyer begins it by introducing very deeply a long tampon of lint, almost cylindrical, hard, embraced by two strong ligatures, crossed on its upper end, knotted, and firmly fixed upon its lower extremity, and the ends of which gathered two by two, remain hanging out of the anus; then he pushes in several balls or fresh loose tampons below this; keeps them firmly in with a strong roll of lint placed between the buttocks over the anal opening; draws on the ends of the two ligatures; knots them over the roll of lint sufficiently tight to draw down the lint contained in the intestine between the bleeding surfaces, whilst the outer tampon tends to crowd it back from below upwards. After this a soft mass of lint, a compress and T bandage, complete the whole apparatus. In this way, it is nearly impossible for the blood to escape, whereas mere tamponing would serve only to make it pour into the intestine, since it could not show itself outwardly, making an inward of an outward hemorrhage, which would be more dangerous still. But, on the other hand, if the pressure is not even, nor powerful enough, if the apparatus of Boyer or J. L. Petit is not in good order, or illy applied, the same accident may occur. Besides which, it sometimes causes great suffering, an insurmountable desire to go to stool, a weight which cannot be endured, colic, fever, and other symptoms which render its use very distressing. It is indispensable, therefore, in many cases, to have an assistant to hold it up for many hours with his hand, to exhort the patient to make no effort, to resist with all his moral firmness the desire to push which he feels, which seldom fail to diminish in violence after a few hours.

I need scarcely add, that if the belly swells, paleness and syncope occurs, with smallness of the pulse, indicating a continuance of the flow of blood; the whole dressings must be removed, in order that they may be better re-applied; nor that the sensation of weight, and of the presence of a foreign body, which are felt so acutely, even though no dressing be applied, will be increased instead of bettered by attempts at defecation to which the patient

is urged in spite of himself almost, but from which, at any sacrifice, he must refrain. I would willingly advise the canula and chemise devised by M. Bermond, if it had ever been tried under such circumstances. (See Dilation of the Anus.) With it, pressure might be increased and diminished, and the dressings changed, modified, and renewed, without undoing the whole apparatus; whilst the removal of the inner canula would allow us to ascertain whether there was any effusion of blood into the intestine, and permit the feces to escape as often as is required, and this for days together if necessary.

The procedure of M. Dupuytren does away with all such precautions. This surgeon almost exclusively employs scissors which are curved on their flat surface for the removal of hemorrhoidal excrescences; and whenever he sees reason to be alarmed about hemorrhage, directly applies the red hot iron upon the wounds which he has made. He then places a very small pledget in the anus, which is supported and protected as I have before mentioned. By this procedure, accidents scarcely ever happen. Neither intestine, bladder, nor circumjacent parts are distended, pulled upon, or irritated by any thing. The congestion, which by the ordinary dressing is made so excessive, is by this means rendered very inconsiderable, and hemorrhage, consequently, has no exciting cause. In this respect, the red hot iron has the effect of making the operation extremely speedy, and is not productive after all of more pain than the use of tampons. The inflammation which has muc less disposition to extend, and to be perceived at a distance from its seat, does not attack the veins which open on the fundus of the wound, and the establishment of purulent foci, caused by phlebitis and re-absorption, which I saw fatal in two patients in 1824 and 1825, at the hospital of the School, is made much less probable. I do not know, indeed, whether the cautery is really indispensable. The branches of arteries divided are so small that at first sight it would not appear that opening them could prove dangerous. When left to themselves these vascular mouths will probably very soon cease to flow; and I should not be surprised if the very precautions taken to guard against hemorrhage, were, in very many cases, the causes of its production. I certainly think that they might be dispensed with in a great many cases; and that to prescribe them at first before the loss of blood seems likely to be abundant, is an excess of prudence. What is there to prevent us from resorting to it at a later period, if the bleeding should continue in such a way as to create uneasiness? Nothing is easier when the wounds are external. If they are deeper, the patient by a little straining will bring them into view of the operator, who may then cauterize them without any difficulty. Lastly, the use of the tampon should be a final resort, which there will always be time enough to call to our assistance. Two patients whom in 1831 I treated in this manner, had no cause to regret its having been adopted.

Art. 4.—*Falling down, Procidentia, or Prolapsus of the Rectum.*

Falling down of the fundament is an occurrence not to be confounded with procidentia through the anus owing to intus susceptio of a higher or lower portion of the bowel of greater or less extent. The one depends on relaxa-

tion of the mucous membrane of the rectum, the latter, on true intestinal invagination. The former alone, calls sometimes for the aid of particular operative proceedings. In children with whom it is very common, the progress of age and the use of proper topical applications, will generally overcome it. Not so in adult age. Its obstinacy then often becomes a source of trouble to the surgeon and of despair to the patient. When the tumor only shows itself after every stool, and then easily returns afterwards, it becomes certainly an extremely distressing complaint, though it does not endanger existence; whilst, if the patient cannot succeed in reducing it, it may become strangulated by the action of the sphincter, inflame, sphacelate, and give rise to most alarming symptoms.

Reduction.—To reduce this tumor, we act precisely as in cases of inverted uterus and vagina. The patient lies upon his back, the breech being raised higher than the abdomen, and all the muscles in a state of relaxation; the rectum is to be wiped off with tepid water, then rubbed over with a mixture of oil and wine; it is then wrapped up in a piece of fine linen, and then compressed gently from circumference to centre, from above downwards with the palms of the hands, or the fleshy parts of all the fingers; whilst the patient is prevented as much as possible from making any effort. Sometimes we succeed better by pressure on the centre of the mass with the tips of several fingers united to form a cone, as if to enter the anus, pushing before them the compress with which the tumor has been capped, and which is held on by the other hand. The operation is not over when the tumor is replaced. A large pledget, with or without a chemise, is frequently used as a means of keeping up the reduced part. A tampon of lint contained in a linen purse, a globe or oval of ivory, wood, or gumelastic; in the female a pessary in the vagina, astringent glysters and hygienic cures, are the means to be essayed for preventing its return.

Division of the Sphincter.—If the reduction of the prolapsus be absolutely impossible in the ordinary way and danger threatens, we must not hesitate to divide the sphincter ani on one or both sides of the root of the tumor. This is to be drawn on one side with the left hand, whilst with the right hand and a straight bistoury, the integuments first and then the fleshy ring are to divided, beginning nearest the intestine, that is, from within outwards. An operation of this kind by M. Delpech on a young person in 1830, was attended with complete success.

Excision.—When nothing prevents the parts from reascending, and yet, in spite of every endeavor they refuse to do so, the only remedy known thirty years ago, and the only one now known by many authors, as able to be performed for the affection, is removal. It is an excision or a resection, which in itself is easy enough, and is performed in the same way as the removal of degenerated piles, a polypus, or any other tumor with a tolerably large base. It is unnecessary, however, to take out the tumor from quite within its root. If the two upper thirds are destroyed, the remainder will inevitably re-enter. It is possible that the success of the operation would be equally certain if the mucous membrane of the rectum were alone attacked and its muscular one respected.

The dressings, and the consequences of this operation, are scarcely different from those which have been detailed under the head of hemorrhoids.

This is, as may be seen, a cruel procedure, and one which is very far from always succeeding. Happily modern surgery almost always avoids it: substituting for it a method much less alarming and less painful, and on the whole, quite as certain; the only objection to which is, that it is not applicable to irreducible procidentia, and can be exerted only upon the tumor after its restoration has been once effected.

Procedure of M. Dupuytren.—This consists in the excision of the radiated folds, which are observed upon the margin of the anus, whether they be, or be not the seat of hemorrhoidal tumors. In a majority of cases, it certainly appears that dilation of the sphincter is the great obstacle to the cure, or else the very great relaxation experienced by the mucous membrane and integuments which follow it outwardly. The cellular tissue which lines them, acquires such looseness after a time, as to allow them to slide with wonderful ease over the layers which they cover naturally; and whose motions in a state of health, they are content to follow. The removal of a certain portion of the cutaneous layer, surprisingly rectifies this anomaly and defect, and thus becomes almost an infallible remedy for the evil which is its frequent sequel.

The idea of the operation first occurred to Mr. Hey of Leeds, in 1788, in the case of a Mr. W. of Hull, who had previously been a patient of Sharps, and in whom the anus continued to be surrounded, after reduction of the prolapsus, by a thin pendulous cutaneous flap, which was eight or twelve lines long, and had at its base and within, several bluish and soft tubercles, such as are seen in persons who have long labored under piles. "It appeared to me," said he, "that the prolapsus depended on the laxity of the very lowest part of the intestine, and of the cellular membrane which connects it with the surrounding tissues." For the author this remark was a ray of light. He conceived that to cure his patient, he had only to increase the adhesion of the tissues surrounding the anus, and the action of the sphincter itself. The surest way of accomplishing his object seemed to him to be to excise the tegumentary flap with its appended tubercles. He was in hopes of causing thereby an inflammation which should be capable of producing a firmer adhesion of the rectum to the circumjacent tissues, entertaining no doubt that a *circular* wound must bring with it a more powerful constriction of the sphincter ani. Mr. Hey accordingly removed the pendant rim and the bluish tumors by a bistoury. This operation he performed on the 13th November, and in March 1789, M. W. wrote him word that his cure had continued uninterrupted. A second patient operated on in 1790 in the same way, recovered in three weeks; in him excision was performed only on one side. In the month of April 1791, Mr. Hey a third time put his plan in execution, removing the pendant flap and encroaching about a quarter of an inch upon the red membrane which covered the anus. His success was as great in this as in the two other instances. He treated a lady in the same way in 1799, except that he removed the two soft tubercles seen on either side of the anus at different intervals of a certain time. She also recovered, and in as short a time. Yet even at home, the success of Mr. Hey remained unremembered, and Mr. Saml. Cooper, who mentions it, speaks of it too vaguely for any one to derive much benefit from it; and but that M. Dupuytren entertained similar ideas, devised a method, and made that method general, it would probably have excited no more attention in France than it had before in England.

The Operation.—A glyster and some mild purgative is to be given the preceding night. The patient is placed as for the excision of hemorrhoids. The surgeon, with good forceps, successively seizes each radius which he means to remove, and excises it with very sharp scissors from below upwards, beginning at the margin of the anus, at about an inch from the sphincter, to end some lines above. According to the account given of it by my old fellow student, M. Paillard, in the Journal Hebdomadaire, M. Dupuytren states that four radii are sufficient to remove; one before, one behind, and two laterally. I have thought proper to remove six in one case on which I operated, and eight in another, because of the relaxation of parts and great dilation of the anal opening. Of course, every ribbon cut away may be made larger or smaller. The solution is begun more or less low, and ended at a greater or less height, according to the state of parts. One of Hey's patients had hemorrhage. I do not know that any of Dupuytren's met with this accident. The English surgeon having left us no detail of his proceeding or his subsequent dressing, &c. we are left in ignorance whether the bleeding was owing to the operation itself, or the way in which it was performed.

The Professor at the Hotel Dieu merely covers the wounds with a soft mass of lint spread with cerate, and either places no tent at all in the anus or a very small one. Twice I have pursued a different course. I passed in a tent as thick as the finger to some depth in the rectum. I separated several little fasciculi, placed them between the edges of each wound, and kept them apart by means of lint, thin compresses and a T bandage. My intention was to prevent an immediate union of the small wounds, to compel them to suppurate that I might obtain a *inodular* cicatrix of more firmness and elasticity, and more solid adhesion than would have followed the original union. I have had no cause to repent of having done so. The recovery was complete; but I must admit that M. Dupuytren's method which is more simple, must be almost quite as good a one, for his patients have all equally been permanently cured of their infirmities.

But any one who knows the difficulty of prolapsus ani and the trouble which it gives, this operation, which I have now described, must be considered a valuable triumph of modern surgery. One of the things which made a great impression on me, when I arrived in Paris in 1820, was a successful case of this kind. I could scarcely conceive how it could be possible that a woman then lying in one of the surgical wards of the Hotel Dieu, who for fourteen years had never gone to stool without having the rectum to prolapse under the form of a red livid tumor, as large as the two fists, should be immediately cured by the removal of a few folds of integuments. It was done, however, and to my great surprise. M. Paillard states that this operation has now, in fifteen years, been often performed by M. Dupuytren, and has failed but once: and even that single failure may be attributed to the course adopted. For my own part, I have performed it but twice upon two women, at the Hospital St. Antoine; and its effects were no less satisfactory.

When the prolapsus recurs at the first stools, which are discharged after excision, it is seldom so decided as before, re-enters of itself with more or less difficulty and soon finally disappears. Looseness of bowels is favorable to its success, as it prevents the patient from straining so much in defecation; and must, consequently, be promoted by injections, mild purgatives, and laxative

drinks. Finally—Excision of radiated folds of integuments around the anus would appear to be sufficient to remedy all cases of procidentia, which depend on a state of relaxation of the mucous membrane, integuments, sphincters, and outer tissues; indeed, in any case not originating in organic lesion, or disorganization of any of the parts contained in the pelvis and hypogastrium. Amputation of the mass should be reserved for cases of intestine prolapses owing to inversion or intus-susceptio and those procidentiæ which are absolutely irreducible.

Art. 5.—Fissures.

Amid the small wounds and ulcers which appear about the anus, one species exists, the only remedy for which thus far, lies in a surgical operation. I mean those cracks or chops so obstinate and so painful, which exist in the tegumentary folds of the anal circumference, which doubtless, from their frequency, must have been often seen, were mentioned by Avicenna and others, who gave them no characteristic distinction, and by Lemonnier more expressly in 1661; for all which, however, they continued to be confounded with chancre and syphilitic ulcers, until M. Boyer first showed their real character and pointed out the true mode of treating them. Whether this be the result, as M. Boyer thinks, or the cause of the spasmodic contraction of the sphincter which is seen to coexist with them; whether caused by the pipe of a syringe, as M. Thebord says he once saw at Besancon, or by the passage of hardened and irregular feces, it is pretty certain that they are seldom, if ever, relieved by any topical application. The Belladonna ointment, spoken of by M. Vivent, and which M. Dupuytren uses, though it may sometimes cure oftener disappoints the expectations of those who use it.

The oil of Hyoscyamus given internally, combined with the introduction of mercurial ointment into the anus, as M. Descude advises, is not so far as I can learn more uniform in its effects. The same must be said of nitrate of silver, extolled by M. Delaunay, and used with some benefit by Beclard; it has failed completely with M. Richerand, and I have not been more fortunate than him with trials I have made with it. Opium and cold water which others praise very much are effectual in but very few cases.

Excising the ulcerated surface, which has long been proposed and practised, will generally cure them; but *incision* is generally so satisfactory in its results, and so commonly known now, that, admitting the knife to be necessary at all, it seems useless to follow any other than the advice of M. Boyer.

The Operation.—Its necessity is pointed out whenever the patient complains of burning pain at each stool, as if a red hot iron were being passed in at the anus; if he suffers but little in the intervals; when the sphincter is so much contracted, as without being disorganized to allow the forefinger to pass only with pain and difficulty; and this, whether the fissure be visible or not; whether it be detected by the finger in the anus or not. The preparations, position of patient, surgeon, and assistants, are the same as in the operation for removing hemorrhoidal veins.

Every thing being in readiness, the operator passes the forefinger of his left hand into the rectum; introduces on it, flatwise, a narrow, straight, probe-

pointed bistoury, held in his right hand above the sphincter; then turns its edge towards the fissure, if he can detect its seat, if not, towards one buttock; has the skin made tense by the fingers of an assistant; then cuts from within outwards the constrictor muscle, in all or nearly all its thickness, being careful to extend the cut on the integuments towards the buttock and a little towards the interior of the intestine. When we do not know where the fissure exists, that there is a fissure at all, or if the disease does not arise wholly from spasmodic constriction of the sphincter, M. Boyer advises us to make an incision on each end of the transverse diameter, and never on its antero-posterior diameter. Even though success do not appear less certain, it is still more prudent to carry the bistoury forwards or backwards, when the crack is situated there, than always to cut on one side at the risk of leaving it untouched.

The only difficulty which is to be overcome, arises in some persons from the softness of the tegumentary layer, either mucous or cutaneous, and its disposition to get away from the dividing instrument. To conquer this, it is very necessary to see that the parts are well stretched. The sphincter, as it offers much more resistance, may be cut with much less effort. Should it be noticed that the inner coat is not cut into, as high up as the subjacent tissues, we must, unhesitatingly, extend the section upwards with straight scissors; whilst the bistoury would be a fitter instrument for enlarging that of the skin downward, if it were necessary.

A tent of moderate size, a square cushion of lint, some compresses, and T bandage suitably applied, constitute the dressings. From the termination of the operation, the lacerating and distinctive pains of the fissure, are changed to those of an ordinary incision; and after the very first stool, the difference is so very marked, that most patients are astonished and delighted. The wound heals by degrees. The dejections resume their primitive regularity. The patient again enjoys the pleasure of repose, and after the cicatrization which is effected generally in less than three weeks or a month, he is as free from all suffering as any one else. Some instances of its failure have been mentioned, but so vaguely detailed as to admit of no conclusion from them. I have never seen it fail in producing its effect. In 1829, it suddenly arrested the agony endured by a woman upon whom I operated at the hospital St. Antoine, which neither dilation, caustic, opiates, or belladonna could allay. However, I am constrained to remark, that two patients upon whom it has since been performed have died of it; and that the incision, which in one was healed entirely and in the other nearly so, had not prevented the formation of several abscesses in the pelvis, about which slight traces of peritoneal inflammation were also visible.

Art. 6.—*Fistula.*

Fistula is one of the most frequent of the diseases which affect the anus, it is also one of the most serious, and has been the most spoken of by authors. Every species of treatment has been opposed to it. By Purmann it was cured by lime water injections, calomel, alum, &c. Pledgets of lint, good living, and detergent injections, answered for pallus. Evers, quoted by Sprengel, was in some cases equally successful with injections of gum ammoniac. If

Titsing be believed, digestive (irritating) ointments do very well. It is known that in the time of Dionis, the waters of Barriege and of Bourbon, and some particular liquids and unguents were extolled as of like effect; but the personal experience had of them by Louis XIV, who himself was the subject of fistula in ano, very soon reduced these panaceas to their proper level. Caustic, which enjoyed greater popularity, and is in fact, of greater efficacy, is mentioned by the oldest authors, and was used in practice under all its forms.

The surgeons of Alexandria employed a linen tent, steeped in the juice of the Euphorbium (lithymale), and dusted over with flour of copper (oxides and sulphate). Leonidas advises the use, on timid patients, of pledgets of lint spread with litharge, or some other catheteric substance. Sublimate and arsenic had each their day, and J. de Vigo knew of nothing so excellent as a tent covered with vermillion. Fallopius gave the preference to the Egyptiacum, and to precipitate. Lemoyne, who lived in the seventeenth century, made himself famous by a corrosive ointment, which he spread on a linen tent. "He," says Dionis, "died rich, because he would always be well paid; wherein he was right, for the public value things only in proportion to their cost. They who dreaded the knife, placed themselves in his hands, and as the number of cowards is very large, he did not want business." For this reason the actual cautery, used by Albucasis, and which D. Scacchi and M. A. Severin dared scarcely to advise, must have obtained the less favor. Although it may sometimes be successful, this method is now wholly abandoned; as is also that of Roger of Parma, which consisted in producing absorption of the callosities with fistula by tents arranged with threads.

§ 1. *Anatomical Remarks.*

As concerned in the operation for fistula, the rectum and perineum require to be examined in another point of view than for that of cutting for stone. The skin as it converges towards the intestine, wrinkles and forms plaits, which are repeated on the mucous membrane within the sphincter, and even extend quite up into the pelvis. Small valves, their concavity being upward, which are to be seen occasionally crosswise between them, give rise to capulæ somewhat resembling pigeon baskets, in which irregular bodies mixed with feces, are easily arrested, in which small abscesses at times originates, and which becomes the starting points of a good many fistulae. The tegumentary and mucous membranes, which are united by a very mobile and yielding cellular layer to the subjacent laminæ, become detached with great ease, and slide backward and forwards upon the other tissues and purulent sinuses which attempt to pass between their outer surfaces and the neighboring elements. The venous network which covers them without, more abundant and better sustained within the ring of the sphincter, is generally compressed above by the accumulation of fecal matters, and by being irritated and subjected to friction during defecation, becomes congested, hypertrophied, changed into erectile tubercles, suppurates and ulcerates, and hence arises another disposing cause of fistula. The intestine, which is flexible and dilatable above the constrictor muscle, where it is supported neither by the point

of the coccyx, or by the aponeurosis, and which is obliged to lean backwards so as to follow the curve of the sacrum, and make room for the bladder, here presents a species of dilation, the lower half or floor of which is necessarily obliged to bear the action of all the solid and irritating matters which endeavor to escape from the digestive passage; which is a third cause again of the occurrence of fistula. As its posterior wall alone suffers this inconvenience, it is natural that most fistulæ should have their roots posteriorly. This portion of the organ is supported below by the fascia pelvica or the levatores ani muscles, and ischio-coccygean; whence perforations in it are more likely to be attended with an effusion of pus into the pelvis than any other. The peritoneum by quitting its sides that it may line the interior of the pelvic cavity, leaves all its posterior edge in close contact with the cellular tissue, which is continuous in the thickness of all the mesenteries. Consequently it is possible that pus, forming on the forepart of the spinal column in the lumbar regions, or even in the thorax, may come down, following the posterior face of the rectum as far as the perineum, give rise to an abscess on the margin of the anus, aud create a mistaken belief in the existence of an anal fistula, a remarkable instance of which came under my notice in 1825, at the Hospital de Perfectionnement.

The Aponeurosis may be considered as forming two distinct systems around the rectum. The outer of these comprises, 1st, the parietal portion of the fascia pelvica, *i. e.* that which covers the obturator and pyramidal muscles in the pelvis, 2d, the ischiatic layer of the ischio-rectal aponeurosis of the perineum, which inferiorly completes the fibrous canal of the obturator internus muscle and on the one side is continuous with the sacro-sciatic ligament, and on the other it closely approaches the inner border of the preceding layer. Taken all together, this system resembles a large vault, fastened by its edges upon the two straits, filled up by the above mentioned muscle; the two planes of which vault incline towards each other, and so unite as to form as it were but one edge at the moment of their injunction. To the other system belongs both the cellulo firbrous layer, which ascends from the bottom of the pelvic excavation up over the outer surface of the intestine; and the rectal leaf of the perineal excavation which lines the surface of the levator ani and the ischio-coccygeus. These two layers compose the second vault, whose concavity is turned towards the rectum, continuous outwardly with the inner edge of the outer vault. Perforations of intestine or pus can get beneath the peritoneum into the pelvis, only by traversing its upper or pelvic layer; and into the ischio-rectal excavation, only after passing through its lower or perineal layer. All fistula which originate between its anal edge, that is to say, above the sphincter and its upper edge, *i. e.* below the peritoneal cul-de-sac, make it possible for both these modes of propagation to be followed; and expose to the formation of burrowings of matter backwards, between the anus and coccyx, and also, between the fibres of surrounding muscles, being pressed downwards, generally only by reason of the pressure of the intestines, or the inconsiderable resistance of the inferior aponeurosis. Such as have their origin a little further down, on the contrary, immediately enter the ischio-rectal excavation, and are but little disposed to spread towards the pelvis. However, the circumstance of the anus being embraced by the fascia, as it

were by a ring between the sphincter and the intestine, explains the way in which fistula that have originated at this joint and opened externally, are so frequently complicated with detachment either of the mucous membrane or of the whole thickness of the rectum for an extent of one to several inches upwards. The enormous quantity of fatty, cellular tissue placed between the thin and the perineal vault of these two systems of the aponeurosis, is consequently the usual locality of those stercoral inflammations which precede the establishment of fistula in ano. It is so much the easier destroyed, either by gangrene or suppuration, as it forms an almost isolated mass in the back part of the perineum; and the vacuum which it produces is filled up with the greater difficulty, that the ischiatic layer of the excavation is immovable, and can no sooner approach the denuded intestine, but the natural action of the rectum interferes to separate them again. This is no doubt the reason of the frequency of blind external fistula, erroneously denied by many modern writers, and of those changes to fistula of abscesses which either do not communicate at all or only secondarily with the anus. Hence, also, arises the disposition to spread which is observed in deep phlegmonous abscesses, to open into the intestine and to produce a blind internal fistula, instead of tending outwardly to the skin. In fact, the rectum, which is always flexible, and very frequently empty, often presents less resistance to them than the skin; besides which, the organism has here no excentric pressure of the viscera, as in the parietes of the abdomen, to oblige the pus to pass towards the exterior. The train laid by the cellular tissue above the coccyx and lower edge of the gluteus maximus muscle, perfectly explains the vast cavities which in certain persons are seen in this direction; and its continuity with the lamellar tissue of the meso-rectum, also explains how an abscess may be caused on the margin of the anus by disease of the sacrum, vertebra, or bones of the pelvis, which may simulate a fistula by extending above the transverse muscle, in the anterior cul-de-sac of the ischio-rectal excavation in man, or in the thickness of the labia majora in woman; and thirdly, how it is that abscesses can make their way through the perineum towards the scrotum, and produce fistulæ which might at first be supposed to be of an urinary nature. Lastly, it is by following these different tracks that certain fistulæ open so far from their point of departure, and perform so complicated a transit.

The arteries are all likewise worthy of some attention. The trunk of the internal pudic is at too great a distance to run any risk at the time of the operation, unless it is necessary to make very large lateral sections. The inferior hemorrhoidal, which it gives off behind the ischium, though often interested, need give no anxiety. They are too superficial, generally too small, and too easy to find, tie, or make pressure upon, for the surgeon really to be afraid to wound them. The branches given by the hypogastrics are likewise too delicate, and are distributed to points too distant from the skin, to be reached by the instrument. The median hemorrhoidal, which form the inferior mesentric at their termination, demaid a little more respect. Situated posteriorly, at first between the lamina of the mesentery and afterwards in the very thickness of the fleshy layer of the intestine, they approach nearer and nearer to the mucous tunic, and continue to be of same size in the laced or net work which they form around the cutaneous extremity of the

rectum. Owing to this arrangement, their section is more dangerous in the posterior half of the organ, than in the opposite direction, and also the higher the operation is performed. From the foregoing remarks, it follows that the greater number of fistulæ in ano being preceded by phlegmonous abscesses in the ischio-rectal excavation, or by hemorrhoidal tubercles must arise within the sphincter, between it and the fibrous ring which exist above, or the pyloric valve described by Mr. Houston. The first person who seems to have made this remark is Mr. Brunel in 1783, or at least M. Pleindoux has since then claimed it for him. But it had not escaped either Sabatier, or M. Larry; although to M. Ribes is due the credit of having established it as a principle. This latter author has, however, gone evidently too far in saying that no others are ever met with. The hundred cases upon which he founds his opinion, however imposing a mass of authority they be, cannot destroy the opposite facts, detailed by other practitioners. M. Boyer and Roux, state that they have operated on fistula, the orifices of which were several inches in depth in the intestine. I treated one myself whose orifice was so high up that it was with difficulty I could reach the spot in the intestine with my finger; and in a patient who died in 1825, at the hospital of the school, it opened backward at three inches above the sphincter. These very elevated fistula, are owing to the impaction of foreign bodies in the dilatable portion of the rectum, and to this list also often belong those cases seen in phthisical patients, the frequent result of tuberculous ulceration of the folliculi or lacunæ of the organ. It is incorrect, however, always to judge of the depth of a fistula, by the vertical extent of the detachment effected; the stylet will often enter without difficulty three or four inches, though the fistula may be seated at a depth of only as many lines.

§ 2. *Examination into the Methods.*

A. *Ligature.*—Caustic, injections, and the apolinosis or ligature, which according to one of the books attributed to Hypocrates, used to be made with five threads surrounded by a horse hair, and was passed through the fistula into the intestine with a brass stylet, have encountered the same fate and are now very seldom employed. In the time of Celsus a kind of packthread was used, which was spread with some escharotic substance. Avicenna preferred twisted horse hair or hog's bristles. Guy de Salicet advises the use of a small string, knotted in several places, to cut the parts; whilst Guillemeau, an imitator of Pare, passed it through a canula by the fistula into the rectum with a double edged needle. Notwithstanding the reasoning of Foubert, who substituted a leaden wire for that generally in use, and who contrived, for the purpose of introducing it, a stylet of a rolling-pin shape; of Camper, who returned to the use of silken or hempen ligatures; of J. J. Bousquet, who recommends that the lead wire be surrounded with lint and passed with a needle; of Desault who employed a directing catheter, then, like Pare, a canula, and also a leaden wire, which he seized in the intestine with his finger or gorget-forceps, to draw its extremity out at the anus, and fasten it by means of a knot tightener; of Flajani, who was satisfied to use a waxed hemp ligature; and, indeed, of most timid surgeons, Apolinosis numbers but few advocates among the practitioners at the present day. The advantage attributed

to it by its advocates are more apparent than real, and are counterbalanced by numerous inconveniences. Its action is very slow. The strangulation which it causes often gives the greatest pain, and nervous contractions, which are really such as to create uneasiness. It will cure complicated deep and multiplied fistula but rarely; and even in the simplest cases is far from always proving sufficient.

The Method of Operation.—If, however, we wish to attempt it, it is immaterial whether we use a strong well waxed thread of linen or silk, or a wire of lead or pure silver. If the first, we pass it through the fistula by means of a sharp flexible stylet; and if the second, we introduce it through a grooved staff or canula; the forefinger of the left hand in either case, being pushed up the rectum, seizes on the thread or wire and draws it out at the anus. The ends are then to be placed in the ball knot tightener of Riolan, Gerauld, or still better, that of Mayor, or else in Desault's instrument, or they may be twisted on themselves, if of a metallic substance. By being careful to tighten, them, as the tissues give way, say every day, or only every two or three days, as the constriction remains greater or is lessened, one may succeed in cutting through the intervening tissues in twenty, thirty, or forty days, so that by the time the ligature is out, the fistula is generally healed. But how many times does it become necessary to remove it before this is accomplished, owing, to the pain it produces, its slow mode of action, and because patients cannot endure it. In 1824, M. Bengon determined to give it a trial at the Hospital de Perfectionnement, upon a courageous and stout adult. The man kept it in for three weeks, complaining of excessive pain each time it was tightened. By the end of this time, the frenum, though of trifling extent originally was not half divided, and as the sufferings increased, it was thought proper to excise it, which was speedily successful. Taking every thing into consideration, ligature, being applicable only to superficial simple fistula, should be given up; and with less regret, because the methods which can be substituted for it, are generally less painful, and as easy as they are safe and certain.

Eccentric Compression.—All surgeons have not yet relinquished the idea of curing fistula without shedding blood in the operation. A means has indeed been conceived of late years which appears to be highly ingenious, the object of which is to close the inner orifice and thus dry up the ulcer. The idea which belongs, I believe, to M. Bermond also occurred to M. Colombe. The first gentleman conceives that this end may be perfectly accomplished by his double chemise canula, applied as we described when speaking on piles: the latter assures us, that he has succeeded in doing it by keeping a hollow ebony cylinder in the anus held by ribbons without. The method may be tried; but it is not yet sanctioned by experience, and too much is not to be expected from it. From an attempt made by the author, it is proved that the mucous membrane of the rectum may become invaginated in the upper aperture of the compressing body and give rise to acute pain. The cutting instrument then alone remains which is capable of adaptation to, and triumphing over every species of anal fistulæ.

B. *Operation properly so called.*

Incision and excision, which have alternately been rejected, the one for the

other, and *vice versa*, are now alone retained in practice, having undergone many changes and improvements; but in such a way, that now, far from being materially incompatible, we often require to combine the two methods, and to employ them in concert.

1. *Incision.*—In spite of their predilection for caustic and ligatures, the ancients very well knew that incision was the best remedy for fistula in ano. Hippocrates says so in so many words, and it is further sufficiently evinced by an instrument called *Syringotome*, a kind of sickle-shaped bistoury, which was employed in the time of Galen. By Leonidas it was performed with an instrument, which ended by a long flexible stylet, which was introduced into the fistula and brought out at the intestine so as to cut the frenum at one stroke. In the middle ages, Hugh de Lucques, first passed a ligature to act as a staff and make the parts tense during the incision. Guy de Chauliac, who was always alarmed at the prospect of hemorrhage, preferred a grooved staff or director, upon which he guided his bistoury, heated to whiteness. Fabricious ab Aquapendente, having dilated the passage with his speculum, employed merely a simple probe-pointed bistoury rather concave, and a staff, for making the incision. Among others, Sphigelius, for example, contrived to encase the syringotome in a curved silver probe-pointed canula which entered first into the fistula, was withdrawn by the fingers, leaving a wire attached to the end of the bistoury, to draw it forward both by point and handle, and divide the fistula at one stroke. Marchett conceived the idea of passing a conducting gorget into the anus for the purpose of receiving the point of the cutting instrument, or of the director. Wiseman dispensed with it, and employed scissors instead of the syringotome, which did not, however, prevent Felix from reproducing Leonidas's bistoury, which he altered by covering it with a cap so as to make its introduction less painful. This instrument subsequently received the name of "royal," owing to the operation performed with it on Louis XIV. During the last century, J. L. Petit demonstrated that a common bistoury, slightly concave, passed upon a grooved staff, was equally as good as any apparatus before extolled; and Ringe made the process as certain as it was possible by advising a gorget like that of Marchett's, and a grooved staff, one introduced into the intestine, the other through the wound, so that by means of a long straight, strong pointed bistoury, made to slide upon the staff, all the parts contained between the two instruments might be divided.

2. Platner thought that he had improved the mode of incision, by proposing to effect it by a bistoire cache, which others generally combined with the gorget. Pott, to simplify it, still further considered that all that was necessary was a curved probe-pointed bistoury. For this B. Bell substituted a narrow bistoury ending by a beak like a catheter. Pott's instrument was modified almost immediately by Savigny, who fixed a pointed blade upon one of its faces, which might be made to draw in and push out at will; and also by T. Whately, who made its cutting edge movable, so as only to draw it after the knob on its blade had been carried into the rectum. Some persons in our own times have resorted to the use of this bistoury; Dr. Dorsey caused the point to be lengthened out into a cone; and M. Dubois makes it advance upon a grooved flexible staff which is previously brought from the intestine out at the anus, by the finger. M. Larrey adopts the old stylet bistoury of Leonidas, reproduced by H. Bass, and afterwards by Brunel. In the way that it is

modified by this surgeon, it is no other than a common straight bistoury, ending in a long, blunt and flexible stylet, which is pushed in at the fistula, and drawn out at the anus, no other conducter being needed for dividing at one cut the whole thickness of the frenum. Lastly, I have been shown one by M. Charriere, the back of which is grooved in such a way that it slips as well upon a cylindrical stem as upon a grooved staff, so that the exploring stylet generally employed becomes its guide; the substitution of the sound for it is not required.

Without attempting to deny the success claimed for each of these numerous procedures, it may at least be asserted that out of the whole armament, the only instruments worth preserving are those which have been kept in use by modern surgeons; viz. the wooden gorget, the grooved staff, the straight bistoury, Pott's bistoury, or the bistoury of M. Larrey.

2. *Excision.*—The mode of performing excision has likewise varied. It is first described by Celsus. "We make," says he, "an incision on either side of the track, and remove all the parts which they enclose between them. "Paul of Egina, resorted to the syringotome, forceps, and an ordinary bistoury. Some have been content to excise all the movable wall of the fistula, after having included it in a loop of thread, &c., or raised it up with forceps or a director, and for this end, employed either the straight or concave bistoury, or curved scissors, as recommended by G. Heuermann. Others thought it requisite to remove the whole track of the fistula, either at one stroke, or by excising the two walls one after the other. Some, the vault being once destroyed, were satisfied with merely scarifying simply and purely its callosities. Those as MM. Boyer and Roux, who now admit of excision, begin by an incision into the passage, and then remove the detached integuments which they take up with forceps, and cut away with strokes of the bistoury,

The Method of Operation.—A purgative given over night, if the state of the digestive organs permits, is necessary to prevent the want of an alvine dejection from being too soon felt. Dionis says, that a "glister should be administered two hours beforehand, that the surgeon may run no risk during the operation, of having his face inundated with fecal matters."

The instruments are the particular kind of bistoury which may be preferred several common bistouries, strong dissecting forceps, a silver and a steel director, the latter without any cul-de-sac, a boxwood or ebony gorget, straight scissors, scissors curved on their flat surfaces, some irons for cautery, needles, ligatures, a long tent of lint, and a tent-bearer, (porte miche) to pass it in with tampons, or the hœmostatic contrivances elsewhere described, (see excis. of hæmorrhoids), some balls of lint, three or four square cushions of lint, long compresses, square compresses three or four times doubled, and a double T bandage.

The patient, when the fistula is upon the nigh side, lies upon his right; on the contrary, upon his left side, when it is upon his left, in front or behind; he is to be doubled up, his head low, his abdomen resting upon a bolster, his lower limb is stretched out, his upper one drawn up and flexed. An assistant standing in front, prevents him from raising his head, and watches over the motion of his arms. The pelvis and the flexed limb are held still by a second assistant. A third assistant, standing behind, is desired to separate the nates and hold the gorget steady at the suitable time. Lastly, a fourth and a fifth are

necessary to hold the other limb, make tense the tissues, and hand instruments, or wipe the wound.

Before proceeding any further, the surgeon now seeks the two openings of the fistula. The external one it can never be very difficult to discover. The fecal moisture or the pus which escapes from it, is enough, with absence of any wound, to point out its situation, though it should be at the bottom of an hemorrhoidal tubercle, or some fold of integument. Not so always, however, it is with the internal aperture. This is usually met with in the centre of a small induration, shaped like the rump of a fowl (en cul-de-ponte) which the forefinger in the rectum will often readily distinguish. It is often not found, owing to our looking for it too far off; it is oftentimes so near the skin, that attention is necessary to avoid overlooking it; and it is not until all the strangulated or right portion of the intestine has been carefully examined, that we are to seek if it be not higher up. A flexible stylet, however, removes the difficulty. It is carefully to be introduced through the cutaneous opening with the right hand, in the direction of the sinus, and letting it follow its different tortuosities without effort, its head will very soon present itself to the left forefinger which is waiting for it in the rectum. When but one external opening exists, this stylet penetrates generally with facility, unless the fistula turn at several sharp angles in its course. When, on the contrary, several are met with, and there are a good many burrowings around the anus, the difficulty sometimes becomes extreme. We must then pass the probe into each separately, acting as aforesaid. Even should these attempts prove fruitless, we are not authorized to conclude that no opening into the intestine exists. Many circumstances may serve to conceal it from the observation of the surgeon. Some milk, if it were to be kept above the anus, would, by flowing out of the outer wound, prove its existence, as it would, likewise, if, when passed in at the latter orifice, it came out at the anus. Any other inoffensive dark colored fluid will do as well. It sometimes happens that the probe is separated from the forefinger only by a pellicle as thin as a sheet of paper, and yet cannot be made to pass bare into the intestine. It moves about in every direction without difficulty. It is easy to feel that the mucous membrane is thin, detached, and yet the probe is seen to remain outside of the organ. Is there, then, in this case an opening at some different part, or is it a blind external fistula? It is impossible to say, and yet something must be done. These cases which were formerly thought very embarrassing, and which are still exceedingly disagreeable to those surgeons who do not think it right to operate, without having first passed through the fistula from one side to the other, are not, in the eyes of M. Roux deserving of all this solicitude. That surgeon, indeed, asserts, that the inner orifice of the passage to be divided does not deserve the importance which is usually given to it. The remedy is the same whether it exist or not. Detachment of the rectum is quite sufficient to justify the operation. The minute researches undertaken by the members of the Academy of Surgery, appear to him to have been nearly superfluous.

For my own part, I think, that although the means of ascertaining whether the ulcer opens into the intestine, we should operate, nevertheless, though it be not found to do so; since the disease has been of some months' duration, and the defecator organ is to some extent detached.

If, then, we have discovered this aperture, and it is not very high up, the

silver staff is substituted for the probe. The forefinger seeking it in the rectum, hooks its beak, lowers it, and bending it a little, makes it come out at the anus whilst the surgeon continues to push it forward with his right hand. The whole of the intervening tissues are then divided at one stroke by a simple straight bistoury, as is used by MM. Richerand, Ribes, Sabatier, and M. Dupuytren, and as I have often done it myself; or else Pott's curved bistoury, that of Dorsey with a conical point, or the slightly concave one of J. L. Petit; its point protected by an assistant, and conducted upon the groove of the staff. The whole operation is extremely simple.

When the fistula extends much higher up, or the detachment is carried very far, it is better to imitate M. Boyer and M. Roux, and employ the steel director with a somewhat pointed beak. It is introduced to the upper part of the abscess. Instead of the finger, which had followed all its motions in ano, a gorget is introduced, and its groove offered to the beak. It is pushed into this gorget in such a way as to pierce the intestine. By moving them backwards and forwards, which causes them to rub against one another, we assure ourselves of their mutual contact. Thereupon, the assistant seizes the handle of the gorget, holds it fast, and turns it outwards a little, as if he meant to give it a seesaw motion. The surgeon does the same to the handle of the director with his left hand; takes a bistoury with a strong point in his right hand; places its tip in the groove of the director; pushes it quickly on to the gorget, and withdraws by raising his wrist and not allowing it to leave the fulcrum which has been given to it. For fear that the whole frenum has not been divided, it is passed in a second and a third time upon the director; then to be sure that nothing remains, the two co-operating instruments are withdrawn together, as if they were but one. If there should remain a cul-de-sac at its upper part, we are forthwith to proceed to divide the abnormal valve which forms it, and lay it bare by means of scissors passed up on the finger. The cutting edge of the bistoury is then turned outwards and applied to the bottom of the wound, which it cuts or scarifies to a moderate degree in its whole length, and which, moreover, it extends at the expense of the skin for an half inch or an inch upon the buttock. Lest the integuments should be detached or thinned, they are divided crucially or in the form of an inverted T; after which each flap is to be seized with the forceps, and cut with the bistoury upon its base, from the free surface towards the wound. But for this precaution suppuration would be interminable and the cure very uncertain. The pain it gives and the time it requires are nothing, in proportion to the advantages which result from it. Prudence does not justify our dispensing with it, except in fistulæ of the very simplest kind.

The same that has been done upon one sinus of the fistula, is to be done upon all the rest, so as to recombine them all with the wound of the rectum. All the tegumentary portions thus formed, are equally excised though but little changed, or though they may have lost all their thickness. The same bistoury, or a probe-pointed one, still directed upon the finger, is, in the last place, to separate each different frenum or valve, which exists at the bottom of the sinuses or the wound, so as to make smooth, without abandoning it, all the interior of the bleeding surfaces, and the operation is then over.

The Dressings, but that the tent should be larger, are the same as those for fissure in the anus. It is necessary after having introduced it, to place a

large dossil between the lips of the wound, above which it should project upwards above an inch. Plenty of lint, with one or two square cushions of it on top, fill up the margin of the anus. The whole is covered by two or three square compresses, and as many long and rather wide ones. The two ends of the T bandage, previously fastened round the abdomen, are brought down over these different objects, passed between the thighs, crossed, brought back in front, one on the right and the other on the left side, and knotted or pinned upon the circular band round the abdomen, complete the apparatus.

Accidents.—Hemorrhage, if any supervene, is to be treated like that which follows excision of hemorrhoidal tumors. The artery which yields it is, if visible, to be tied with a ligature or twisted. If it is not, the pulp of the finger is to be passed down into the wound, so as successively to compress it at every point. As soon as chance conducts us to the vessel the bleeding ceases. There, consequently, it is that we must apply small balls of lint, dusted or not with some styptic powder or steeped in some liquid. The tent and other portions of the dressings, are then applied as before stated.

If we do not succeed, and tamponing the whole bleeding surface does not answer either, we may take our choice between actual cautery, Levret's bladder, Blegny's gizzard, Petit's tampons, adopted by Boyer, or M. Bermond's apparatus, though such an emergency will be found to occur very seldom; particularly as the bleeding which sometimes follows the operation for fistulæ in ano, does good rather than harm, and almost always ceases spontaneously before it gets to be alarming.

Advocates for incision exclusively, do not pursue precisely the steps we have detailed. Denudation of the rectum is not with them a sufficient reason for extending the incision of it above the fistula. They maintain that after the operation the intestinal wall again reapplies itself and grows fast to the suppurating surface; that the same thing happens with the cutaneous flaps and indurations, they do not fail to fasten again or to disappear, whenever the fundus of the fistula is again continuous without an intermediate frenum with the anus, and is no more than a groove or fissure in the intestine; that the length of the operation is in this way much diminished, and very much so the sufferings of the patient, and the time of the suppuration and cure; that there is much less fear of hemorrhage and fever; that less deformity ensues; lastly, that the important point is to interrupt the continuousness of the sphincter, which, by confining the fecal matters, obliges them to find their way partially through the track of the fistula.

To this reasoning it may be replied, that if, indeed, in a good many persons, the thinned and denuded parts do ultimately grow fast again after mere incision, the reverse is also not unfrequently seen. Why should it be otherwise? We see in this what we see daily in every part of the body. No one at the present day has any doubt that the best way of treating an endless host of cutaneous ulcers, is to cut away the thin and livid edges which cover their fundus. Section of the sphincter is not always made. It is not this muscle, in fact, but the fibro-muscular circle situated above, which forms the most contracted part of the anus. And after all, what is it that we fear? Loss of substance in parts as soft as these is soon restored. The pain is less acute than is generally supposed. The parts owing to their being thin, and as it were, dissected off, contain no vessels of large caliber. Diffi-

culty there is none to those who know how to direct a bistoury. In a few seconds, every flap will be seized and excised. The patient whose mind is made up to endure the operation, will prefer to suffer rather more and have every possible chance to recover certainly and speedily. On the other hand, excision in this way is only done for fistulæ which are attended with very marked detachment. It bears only upon the skin, and the whole is confined to pure and simple incision, when the passage to be destroyed is surrounded by no disorganization. In a word, the indications which we are to fulfil, may be considered as existing under two points of view; 1st, to dry up the source of the fistula by incising the rectum; 2d, to put the wound into such a condition, as shall conduce to its speedy and easy cicatrization.

Fistulæ which open upon the anterior wall of the rectum require more care than the others. We must not perform excision of them without a very manifest necessity for so doing. A bistoury carried up to their fundus with this view, would soon reach the bladder, peritoneal cul-de-sac, or prostate, to which risk the patient should not be exposed. When they reach very high up, no matter in what direction, the operation is at once more difficult and more dangerous; not, however, for fear of wounding the peritoneum, though the fistulæ reached to the sacrum; practitioners who have pointed out this risk, having, doubtless, forgotten that the diseased aperture is only in the mucous and muscular tissues, and not at all in the serous one; that the pus burrows in the cellular tissue and not in the abdominal cavity; that if the peritoneum were to be ulcerated there would be effusion into the abdomen, constituting a disease almost necessarily fatal, or too serious at least to admit of thoughts of any operation; that as the bistoury is not at liberty to leave the groove of the director which has been chosen for it, it is next to impossible it should touch the peritoneum though the surgeon should make the atttempt, and that every thing considered, there is not more to be feared from wounding this membrane superiorly than inferiorly, in the front rather than the back portion of the intestine. The danger arises from extending the incision beyond the lower limits of the ischio rectal aponeurosis, or even the inner edge of the pelvic aponeurosis, which gives rise to purulent infiltration between, first, the two laminæ and into the pelvis, and, secondly, between the peritoneum and fascia pelvica. All that precedes is to be understood of such fistulæ in ano, as are invariably kept up by some local vice, by solution of the cellular tissue, or by perforation of the rectum. Such as result from caries, necrosis, or any morbid alteration whatever of the ischium, coccyx, sacrum, or vertebræ, which arise from deep seated suppuration in the belly or thorax, are nothing but symptoms, whose causes must be removed before their cure can possibly be effected. When modified by syphilis, or some morbific constitutional affection, if we are desirous of operating, the patient should at least be at the same time subjected to such general and specific treatment as the disease indicates. It is to neglect of this precaution, that surgeons expose themselves to see the wound obstinately continue open, and suppuration remain such as they cannot dry up, though there exists no anatomical alteration which could interfere with its cicatrization.

A rule which experience has established, is that this operation should never be performed on persons laboring under phthisis: 1st, because most frequently the fistulæ retards the progress of the consumption: 2d, because it is usually

produced by the ulceration of one of the thousand tubercles by which, like sieves, all the organs are perforated; 3d, because the wound will not heal, discharges profusely, and reacts on the organism in a very dangerous manner: 4th, because if by chance it does heal, it is observed that the disease, which is checked for a moment, seldom fails to be much aggravated subsequently by it. This, however, is no reason for creating artificially a fistulæ in ano in tuberculous patients by passing a long instrument like an arrow per rectum, enclosed in a stout canula whence it escapes when required, in such a way as to pierce the intestine from within outwards, and from above downwards, emerging at the margin of the anus, bringing with it a seton which is intended to be left in the wound, as was proposed by M. Heurteloup, and I believe once done by him at La Charite. This method offers no more advantages than would a seton in the nape of the neck, or a blister to the arm. I even think that in certain cases, by the pus which it furnishes to the general circulation, fistula in ano may contribute to the production of tubercles, rather causing phthisis pulmonalis, than acting as a remedy for it. The rarity of blind internal fistulæ depends upon two causes: first, to their speedily becoming complete fistulæ; secondly, to the ulceration, in the contrary case, being so slight as to admit of their spontaneous cure. This I saw in a patient, in whom I was obliged to open within the rectum, an extremely painful abscess, which could not be detected from without, but which evidently projected into the intestine, and whence more than a glass full of pus was discharged. To operate upon this sort of fistula we endeavor to change them to complete ones, either by placing a tampon upon the aperture for the purpose of retaining the pus within, or else by means of a stylet curved like a hook passed per rectum, the short branch of which we endeavor to pass into the ulcer. These means enable us to see with what point in the perineum the burrow of matter corresponds, and to open it with one stroke of a bistoury. However it seems to me, that having once discovered the orifice in the intestine, these researches become unnecessary. The instrument carried flatwise on the finger, and having a ball of wax on its point, would answer very well by cutting the rectal wall of the sinus, from above downwards, and from within outwards, as if we were treating an ordinary abscess, in such a way as to divide the sphincter, if it be judged advisable. As to the question of the propriety of operating on a fistula with the same stroke that opens the stercoral abscess, as Faget advised, or whether it be not better at first to make only a puncture, and defer the operation to a later period, which is the course advocated by Foubert, it is now unanimously decided in favor of the latter writer: first, because the introduction of the finger or gorget would cause too much pain; secondly, because not being able to discover where the aperture is, nor how far the detachment extends, it would be most frequently necessary to recommence the operation after some time; thirdly, because many of these abscesses, when once opened, get well without anything else being done, as Foubert had already stated, and several instances of which I published myself, and of which I have since then seen three other examples. Attention to the dressings is a capital point after the operation for fistula in ano. Almost all French surgeons maintain that a strong tent should constantly be kept in the rectum, or that, at least, there should always be a fasciculus between the lips of the wound. Without this, say they, cicatrization may commence first

towards the mucous membrane and thus the fistula be re-produced. The cure can only be solid and certain, when it proceeds from the bottom towards the edges of the incision. A patient who was going on very well was for a short time abandoned by Sabatier, who perceived by the end of three weeks that the fistula had formed again, and that the assistant to whom he had confided him, had not used the tent judiciously. The incision was recommenced. Every dressing was performed with the greatest care by Sabatier himself, and this time the disease completely disappeared. M. Boyer makes use of absolutely the same language, and states facts precisely parallel. Ponteau, who has powerfully opposed this doctrine, however, asserts as warranted also by experience, that the tent is not only useless but injurious, owing to the irritation and compression which it exercises upon the bleeding surface; which, according to him, requires no other treatment than that of a simple wound which is left to suppurate. The principles of Ponteau are universally adopted in England. A strip of fringed linen or a few pledgets of lint is all that it is thought proper to place between the edges of the fistula; and Mr. Samuel Cooper, among others, does not understand what he calls the French routine. Upon this point, as upon so many others, I think it easy to come to a right understanding. It is not probable that practice offers as much difference on the question as books do. The object is to prevent the union of the lips of the wound before the action in the fundus has been altered, to compel it to cicatrize gradually from its sides towards its deepest points. Now to accomplish this what is required? The fringed linen will not always answer, for it will be most frequently thrown by the wound into the anus itself. Neither is the large cylinder of thread which is in use among us indispensable, for we can with a tent much smaller and more flexible, keep the solution of continuity sufficiently apart. It has, moreover, the serious inconvenience, when its use is too long continued, of flattening the cellular granulations, the development of which it likewise impedes. Reasoning and experience concur in the assertisn, that a tent of moderate size is advantageous during the first ten or twelve days; that afterwards it may without injury be gradually diminished in size; and that as soon as the surface of the wound seems red and disposed to cicatrize it is useful to dress it flat with soft lint. In all other respects this wound is to be treated like any other, and also the different symptoms, local, or general, which may occur during the course of recovery.

Art. 7.—Cancers.

No part is more liable to lardaceous and even cancerous degeneration, than the end of the rectum. This disease sometimes presents itself under the form of tumors more or less prominent, and of greater or less sized bases; sometimes appearing like a perforated diaphragm, particularly when the valve described by Mr. Houston is the seat of the affection; sometimes like flat surfaces, more or less extended in height, thickness, or in width which occasionally occupy the entire circumference of the organ. When topical applications, divisions of the frena and compression have proved insufficient, and the disease progresses in spite of their use, it will, it is to be feared, whether cancerous or not, end fatally if some more effectual remedy is not opposed to it.

Extirpation is a last refuge to which the mind then naturally reverts. The idea occurred to several persons, who all shrunk before the danger and difficulty of applying it to practice. Desault thought it should be proposed for such tumors only as were of a bad character, very limited in extent, movable, and the different ramifications of which it was easy to reach. M. Boyer is of a similar opinion. The whole of this school of the old Academy of Surgery had coincided in this sentiment, which is that of Morgagni originally, when some years ago M. Lisfranc undertook to establish the contrary opinion. The cancerous anus can, according to him, be extirpated entire like the breast, testis, or any other organ of the body. The surgeon who undertook it during the time of Morgagni, could not, it is true, accomplish it; and Beclard, who, according to M. Paris, used in his course of lectures upon Operative Surgery, at La Pitie in 1822 and 1823, maintained that in the present state of surgery, scirrhous induration of the rectum need not prove necessarily fatal, as the parts diseased should be removed, taking every precaution warranted by the nearness of the bladder, and by the numerous vessels which surround the lower end of the rectum, had never any opportunity of performing it. Faget would appear to have first done it with success, on the 9th June, 1739, in the presence of Boudon and his brother. He excised about an inch and a half from the circumference of the rectum. What surprised him most, was to see defecation go on in the new anus, as it had done before the operation, although nearly all the sphincter, or the plane of circular fibres which surround the anal opening, had been amputated. After an attempt to explain the formation of a new constrictor muscle, and to account for the mechanism by which M. Gele was enabled to retain both solid and liquid fecal matters, and even wind, Faget draws the conclusion that extirpation of the anus, to even a considerable height is practicable. It fell to the lot of M. Lisfranc to put this opinion to the test. His first patient upon whom he operated, February 13th, 1826, was perfectly well on the 13th of April following. He obtained a like success in the month of January, 1828, in the case of a woman, and a third in another woman, operated on the 15th July and cured October 28th of the same year. In a fourth patient the cure remained doubtful. A fifth died on the 10th March, 1829, four days after the operation of pelvic suppuration, and probably of phlebites. A sixth, a man aged seventy-two years, died on the following day, the autopsia of which it was not practicable to make. His seventh patient died at the end of twenty-five days, also having pus in the pelvis and veins. The thesis of M. Pinault, which contains all these facts, contains also two other cases of recovery, whence it follows that in the month of August, 1829, that M. Lisfranc had performed nine of this kind, five recovery, one partial success, and three deaths. I do not, therefore, see why we need hesitate to follow his example, whenever a necessity occurs for so doing.

The method of Operation.—The patient prepared, situated and held as if for a fistula, except that instead of one thigh only, both should be separated by a pillow and fixed at a right angle on the trunk, whilst an aid draws the buttock asunder, and makes tense the skin; the surgeon, by means of two demi-lunar incisions which come together at the coccyx and at the perineum to form an ellipsis, encircles the disease below; dissects the ellipsis upon its outer face from below upwards, first to the right and then to the left; detaches

it gradually from the neighboring tissues, being careful to leave nothing of diseased character without; stops when he comes to the sphincter; introduces the left index finger into the anus; uses it as a hook to depress the scirrhous ring, which he tries to bring outwards, whilst at the same time the assistant pulls upon the dissected ellipsis; takes the bistoury in his right hand, continues to incise circularly the adhesions of this portion to the surrounding parts, to be beyond the extent of the disease if possible, and concludes by detaching the whole mass by large incisions with scissors curved on their flat side, or else with the bistoury which he has used all along.

When the cancer is deeper and more adherent, or comprises a greater thickness of tissues, M. Lisfranc begins with good scissors to divide the angle or posterior wall of the dissected ellipsis vertically, and extends this incision high enough up into the rectum. His assistants then pull with strong hooks or forceps upon the rest of the circle, whilst the operator extends the division as far as possible upwards with the bistoury, guided by the finger in the anus, and by the thumb applied on the outer surface of the flap. When he has proceeded beyond the limits of the disease, the curved scissors may be taken instead of the bistoury, in order to separate the dissected mass, circularly from the portion of rectum which is to remain. Its extremity is carried into the coccygean fissure, so as successively to embrace either half, and to cut them from behind forwards, being careful to do so upon healthy tissues only, and use double caution as we near the genito-urinary organs.

In operating on a female, a well informed assistant is to keep one or two fingers in the vagina, and to watch the motions of the knife or scissors in that direction, whilst the surgeon is dissecting away the cancer forwards, or is attempting to do, at great depth. In the male, the urethra, bladder and prostate render this stage in the operation one of still greater delicacy. A large catheter in the natural passages, is doubtless an invaluable guide, which would be but a trifling support, however, had the surgeon not "in his minds eye" all the requisite degree of knowledge as to the anatomy of the perineum, or if he were not accustomed to the use of a knife. When the operation is over, the operator passes his finger over every point in the wound, and if he detects any tubercles, portions or parcels of diseased tissue which have escaped him, seizes them directly with a hook or forceps, and with a bistoury or scissors at once incises them, whether internal or upon the skin. The divided arteries belong to the same branches which are met with in the operation for fistula in ano; to which, in some cases, must be added the transversa, and superficialis perinei. All those which are noticed as they are cut, are to be tied, otherwise there would be much risk of not finding them afterwards, because being stretched and elongated at the time they are cut, they ascend very high into the pelvis, and if we endeavor to draw them out by pulling upon the end of the rectum, the compression they undergo prevents their springing. Still, they are very seldom large enough to cause any serious hemorrhage. If, however, it occurs, refrigerants, styptics, and balls of lint, methodically applied, tamponing, and in short all the means detailed in former articles, must be opposed to its progress. If during the operation so much blood flows as to interfere with the operator, we may, as M. Lisfranc is made to say by M. Pinault, wait a few moments, and arrest it by lint steeped in cold water, unless ligature or torson can be applied.

The tent is of more importance after this operation than after all others. It must be large and long. The finger must precede it; bear it strongly backwards to find the new aperture of the rectum, and afterwards tilt it in an opposite direction to cause it to penetrate easily into it. A soaked rag, spread with cerate, is applied upon the bleeding surface, receives its extremity, to which is added some raw lint, compresses, and the double T bandage. By neglecting to use the tent in the beginning, and merely spreading a perforated linen rag to receive the lint over the wound, as M. Lisfranc did; and only recurring to the use of tents about the tenth to the fifteenth day, the first dressing is perhaps rendered more quick and rather more easy, but to me it seems to create difficulties for the future; and that it would be more reasonable to do as I have before described.

For a few days the patient is flooded with a discharge of grey, or blackish pus, mixed with feces; the wound then deterges gradually, and from the fifteenth to the twentieth day begins to contract. The skin is, as it were, drawn towards the pelvis, and the orifice of the intestine becoming adherent to the parts around, approaches the surface at the same time, so that at the end of the cure there remains only a loss of annular substance of about an inch in height, or even less; the preserved fibres of the levator ani, of the aponeurosis, of the termination of the rectum, and other tissues blended into one ring, reproduce to a certain point the sphincter muscle, supposing it to have been removed, and thus, after the cure there is much less disfigurement than might have been at first supposed.

For this cure to be certain, and to be followed by no relapse, the use of dilators must not suddenly be abandoned. The new anus has so great a tendency to cohere, that if the tents were not to be persevered in for at least some weeks after the healing of the wound, and returned to, from time to time, for several months, most patients would, ere long, be affected with a contraction here, by which the fruits of all their sufferings and the benefits of an admirably constituted operation would be wholly lost. From this we see that cancer of the rectum may be subjected, like that occurring in the breast, to the chances of removal, whenever it may appear practicable to remove the whole disease, without too much havoc in the parts; that is to say when it may be easily passed with the finger, when it is confined to the parietes of the intestine, and has not yet gone beyond the line of demarcation between the constituent parts of the ischio-rectal excavations.

In other cases, and whenever its adhesions with the vagina, bladder, prostate, or urethra are too close to be easily destroyed, it must be renounced here, as under the same circumstances, would be done any where else.